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INVENTORY

EQUIPMENT STATUS FOR THE
MARINE CORPS FIELD LOGISTICS SYS

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APPENDIX A

EQUIPMENT STATUS

FOR THE

MARINE CORPS FIELD LOGISTICS SYSTEM

FINAL REPORT

DECEMBER 1980

APPENDIX A

EQUIPMENT STATUS FOR THE

MARINE CORPS FIELD LOGISTICS SYSTEM

Final Report

December 1980

Prepared under
U.S. Marine Corps
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SECTION 1

INTRODUCTION

To develop the Field Logistics System (FLS) Master Implementation Plan requires a review of the status of each FLS item and its associated FLS dependencies, an identification of the equipment it is to replace, and a determination of when replacement should occur. To accomplish this, the methodology employed was to:

- Identify each item of the FLS.
- Identify the existing equipment which will be replaced.
- Determine the development status of each FLS item and its impact on total system implementation.
- Determine the availability of each item for procurement.
- Determine the quantity of FLS items required to effectively replace existing assets.
- Project production unit costs.
- Determine existing asset age, life cycle, and future useful life.
- Recommend the phase-out or disposal of existing assets and introduction of FLS items.

The aforementioned methodology formed the basis for the equipment data baseline used in development of the various plans required for system implementation. The data base is periodically updated as new information is available.

The following sections describe each of the FLS items and provide a detailed informational status of each element as collected to date.

SECTION 2

CONTAINER SUBSYSTEM

2.1 INTRODUCTION

The container subsystem, an essential portion of the FLS, is a logical outgrowth of the fundamental need to improve methods of handling and moving material in military operations. Specifically, the current process of fabricating containers and gathering and packing organizational property and consumable supplies impinges upon the readiness of Marine Corps units to rapidly deploy for military operations. The handling and moving of material are especially critical in amphibious operations where reliance for initial success is placed upon the ability to rapidly move essential equipment and consumable supplies from the ship to shore. The ability of the force to maintain pressure and proceed to the military objective depends, to a considerable degree, upon the rapid follow-on movement of material ashore to sustain the operation. The use of modern containers with versatile handling features offers a reasonable and effective alternative to the locally fabricated wooden containers currently employed.

Paralleling this new mount-out approach, the transportation industry is dramatically shifting from the breakbulk method of cargo handling and shipping to the employment of prefabricated containers and the requisite transport and handling equipment to accommodate them. This shift by private industry and the beneficial features inherent in containerization, such as secured cargo in transit, improved loading and discharge rates by 50 percent over the breakbulk method, and improved ship turnaround times have been recognized by the Department of Defense (DOD). Accordingly, DOD has promulgated both research and operating guidance for future employment of commercial and military general- and special-purpose containers, and for the supporting facilities and equipment. In consonance with this guidance, it is timely that the Marine Corps has included the container subsystem within its FLS. This approach takes advantage of advanced technology in shipping and cargo handling and is consistent with the general objective of DOD to maximize containerization through the adoption of container-oriented logistics systems. The components of the container subsystem are described in the following paragraphs.

2.2 INSERT

Description. The insert is a 10"x17"x45", reusable, prefabricated container with an exterior volume of 4.4 cubic feet. The interior usable volume, allowing for material thickness, is 3.5 cubic feet. Its tare weight is approximately 35 pounds with lid, 28 pounds without it, and the cargo capacity is 120 pounds. Its maximum gross weight of 155 pounds permits manual handling. The insert features molded plastic construction, handles at each end, interior dividers to separate and organize the contents, and an easily opened lid. The insert will be used to pack and ship organizational property and consumable supplies. It is designed to fit into a rack within the PALCON and QUADCON to form a bin-drawer storage container. Six inserts will fit within the PALCON and 36 of them within the QUADCON. Thus, in garrison and in the field, the insert will serve as a storage bin-drawer for stockrooms and supply activities. The insert may also be employed separately as a field box instead of a bin-drawer within the PALCON and QUADCON.

Replacement. The insert is a replacement for the current wooden mount-out box which has 11"x16"x41" exterior dimensions and an exterior volume of 4.2 cubic feet. This box is fabricated by the user from materials provided through the supply system.

Development Status. The insert was designed by Rohr Industries, Inc., under contract with the Civil Engineering Laboratory (CEL), Port Hueneme, California. Through a subsequent contract, Rohr Industries produced 36 prototypes which were delivered to CEL in the third quarter, FY80, for engineering test and evaluation.

Test Schedule. Development and operational testing will be combined to the extent practicable. Test and evaluation of the prototypes commenced during the fourth quarter, FY80. All development testing has been completed except the cold chamber test at Point Mugu, California, which is now scheduled for December 1980.

This initial testing effort involved laboratory analyses of a developmental nature with only limited operational evaluation. The insert met functional expectations though there is a design problem which is discussed below. Operational evaluation will be given primary consideration during the test and evaluation of the next iteration of prototypes. These are to be procured in FY81 and operationally evaluated in FY82.

Development Problems. The thickness of the molded plastic in the present first-generation prototype is excessive. This resulted from a failure to change the design drawings when a change was made in the engineering plastic to be employed in fabricating the insert. As now molded, the insert's tare weight is also excessive and measurement of its cargo weight and cube capacity would not give valid results. No hand tooling has been procured, therefore, the impact of the error is not significant in this regard. A soft tooling (layup) process was used in fabricating the current prototype. The design drawings will be

corrected to coincide with the type of plastic to be used in fabricating the second-generation prototype.

Quantity. The total quantity of inserts required is 41,002, as shown in the tabulation below. This quantity was derived from an evaluation of the classes of supply; number of line items in each class; size and weight of the items; suitability of the items for handling and storage in the insert; authorization of material; and the personnel, mission, and functions of each type unit in the Fleet Marine Force (FMF).

FMF 60-Day Quantity	
• I MAF	10,296
• II MAF	10,212
• III MAF	9,198
• IV MAF	9,696
ORF	1,600
Total	41,002

The insert has not been allocated for pre-positioned war reserves (PWR), mobilization training, maintenance float, and other purposes, in view of the nature of the item and its planned employment. Rather, a significant quantity has been included in the operational readiness float (ORF) in accordance with long-standing guidance by HQMC (Code LM-2).

Cost. The cost of the insert with lid, handles, and dividers was estimated by Rohr Industries in 1978 to be $40. This estimate has been increased to $50 in terms of FY82 dollars to account for inflation and may increase further when detailed production costs are calculated from a final engineering design, especially when costs of manufacturing processes for liquid plastic are completely considered for this state-of-the-art material. The 1974 cost of the wooden mount-out box was $12.93, including labor, according to the MCLB Barstow. The escalated cost in FY82 dollars at about 7 percent per year is $22.20. The service life of the current mount-out box is approximately 1½ years as compared to a minimum of 5 years for the insert. On this basis, the insert would be cost-effective at an acquisition price of $74. However, in view of the more favorable attributes of the insert over the mount-out box, no direct comparison on a cost basis alone should be made.

Phase-in. The short life span of the wooden mount-out box permits its early replacement by the insert. Accordingly, phase-in will be governed by the time required to complete the RDT&E process, availability of funding resources, and procurement leadtime. It is anticipated that procurement will start in the third quarter, FY83, with deliveries from production continuing at a rather level rate into FY91 when provision of the insert to all MAFs should be completed. The scheduled phase-in is indicated below:

	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91	Total
Quantity	5,306	5,306	5,348	5,348	4,799	4,799	5,048	5,048	41,002

2.3 PALCON (PALLET CONTAINER)

Description. The PALCON is a 41"x40"x48", weatherproof, reusable, prefabricated container. The exterior volume is 45.6 cubic feet while the interior usable volume, allowing for material thickness, is 31.5 cubic feet. It has a tare weight of 360 pounds and a cargo capacity of approximately 890 pounds, for a maximum gross weight of 1,250 pounds. The PALCON features a structural steel frame; top, side, and door panels of plastic molded over steel stiffeners; and a floor of high-density plywood covered on both sides with sheet steel. Two doors on one 40-inch side have weatherproof sealing strips and latches to accommodate a lock. It has a pallet base with tineways for four-way forklift handling. It can also be handled by sling from a crane or helicopter.

The PALCON has an integral fastening capability to permit coupling and handling of up to eight units in a 2x2x2 array which can be lifted with a sling or by forklift. Twenty-four PALCONS can be accommodated by the 8'x20' logistics trailer. The PALCON is compatible with the stowage areas in amphibious ships.

A rack is being developed to provide the PALCON with an optional bin-drawers configuration. The rack will house six inserts for use as bin-drawers for small items. It is a molded plastic and aluminum assembly which is hinged to enable it to be collapsed for storage when not employed in the PALCON.

The PALCON will be used to pack and ship organizational property and consumable supplies. In garrison and in the field, it will serve as a storage cabinet for stockrooms and supply activities.

Replacement. The PALCON is a replacement for the current 36"x32"x40" and 43"x 40"x48" wooden box pallets and will obviate the need for a number of flat pallets. These pallets are now constructed by the user from materials obtained through the supply system.

Development Status. The PALCON was designed by Rohr Industries under contract with CEL. Through a subsequent contract, Rohr Industries produced eight prototypes, plus a PALCON rack, which were delivered to CEL in the third quarter, FY80, for engineering test and evaluation.

A change in design will eliminate the flat bottom when the next iteration of prototypes is produced, since it is considered functionally and operationally unnecessary while adding to the tare weight.

The appointments for the PALCON to obtain a complete container ready for employment, including cargo tiedown fixtures, documentation receptacles, and other items, have not been detailed as yet.

Test Schedule. A demonstration model withstood handling tests successfully, especially for frame and floor design and arraying capabilities, at Camp Pendleton, California, in June 1978. Further development and operational testing will be combined to the extent practicable. Test and evaluation of the protoype commenced during the fourth quarter, FY80. All development testing has been completed except the cold chamber test at Point Mugu which is now scheduled for December 1980. Testing concentrated on laboratory analyses of a developmental nature with only limited operational evaluation. The PALCON and PALCON rack met functional requirements though they have a design problem identical to that discussed for the insert. Operational evaluation will be given primary consideration during testing and evaluation of the next iteration of prototypes. These are to be procured in FY81 and operationally evaluated in FY82.

Development Problems. The design problem addressed above as well as with the insert extends to the PALCON racks and, again, results in an excessive tare weight.

Quantity. The total quantities of PALCONs and PALCON racks required are 24,065 and 3,895, respectively, as indicated below. These quantities were derived from an evaluation of the classes of supply; number of line items in each class; size and weight of the items and their suitability for handling and storage in the PALCON; authorization of material; and the personnel, mission, and functions of each type unit in a MAF.

	PALCON	PALCON Rack
FMF 60-Day Quantity		
• I MAF	6,009	990
• II MAF	5,981	994
• III MAF	5,460	891
• IV MAF	5,694	920
ORF	800	100
Special Mission Forces	121	
Total	24,065	3,895

For the reasons discussed under the insert, no PALCONs and PALCON racks have been allocated for PWR, mobilization training, maintenance float, and other purposes.

Cost. The cost of the PALCON was estimated by Rohr Industries in 1978 to be $500. This estimate has been increased to $623 in terms of FY82 dollars to account for inflation and may increase further when detailed production costs of manufacturing processes for

liquid plastic are completely considered for this state-of-the-art material. The 1974 cost of the 36"x32"x40" wooden box pallet now in use was $42.14 according to MCLB, Barstow. The escalated cost in FY82 dollars at about 7 percent per year is $72.41. The service life of the box pallet is approximately 1½ years as compared to a minimum of 5 years for the PALCON. The box pallet accommodates 19 cubic feet of cargo while the PALCON handles 31.5 cubic feet. On the basis of these considerations, the PALCON would be cost-effective at an acquisition price of $400.16. However, in private industry, the service life of reusable cargo containers is approximately 15 years and while a service-life minimum of 5 years is a design criterion for the PALCON, a true service life of 7 years or more appears reasonable. On the basis of 7 years, the PALCON would be cost-effective at a unit price of about $560.22. In view of the more favorable attributes of the PALCON over the box pallet, including weatherproof and secure storage during shipment and in the field, and the improved handling of cargo which it affords in carrying out amphibious operations, no direct comparison on a cost basis alone should be made.

The cost of the PALCON rack was estimated by Rohr Industries in 1978 to be $51.42. This estimate has been increased to $69 in terms of FY82 dollars to account for inflation. Approximately 16.2 percent of the PALCONs will have racks for supporting inserts.

Phase-In. The rather short life of the wooden box pallet permits early replacement by the PALCON. Accordingly, phase-in will be governed by the time required to complete the RDT&E process, availability of funding resources, and procurement leadtime. It is anticipated that procurement will start in the third quarter, FY83, with deliveries from production continuing at a rather level rate into FY91 when provision of the PALCON to all MAFs will be completed. The scheduled phase-in is indicated below:

	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91	Total
PALCON	3,212	3,090	3,105	3,104	2,830	2,830	2,947	2,947	24,065
PALCON Rack	509	510	507	508	458	458	472	473	3,895

2.4 QUADCON (QUADRUPLE CONTAINER)

Description. The QUADCON is an 82"x57½"x96" closed, weatherproof, reusable, prefabricated container with an exterior volume of approximately 262 cubic feet. The interior usable volume, allowing for material thickness, is 210.5 cubic feet. It has a tare weight of 2,565 pounds and a cargo capacity of 7,435 pounds, or a maximum gross weight of 10,000 pounds. The QUADCON features a structural steel frame; top, side, and door panels of plywood covered with plastic; and a floor of high-density plywood covered on both sides with

sheet steel. Double doors on each of the 57.5-inch sides have weatherproof sealing strips. It possesses American National Standards Institute/International Organization for Standardization (ANSI/ISO) corner fittings for intermodal containers and a base with tineways for four-way forklift handling. It can also be handled by sling from a crane or helicopter.

The QUADCON is capable of being connected to permit forming arrays of two, three, or four units. A four-array of QUADCONs is nearly equivalent to one 8'x8'x20' commercial container and can be accommodated by the 8'x20' logistics trailer and the 20-foot cells of containerships.

A rack provides the QUADCON with an optional bin-drawer configuration. The rack houses 36 inserts for use as bin-drawers for small items. It is a bolted aluminum assembly to facilitate disassembly and storage when not in use and is assembled within the QUADCON using $\frac{1}{4}$-inch bolts.

The QUADCON will be used to pack and ship organizational property and consumable supplies. In garrison, it will serve to store materials for deployment readiness; in the field, the QUADCON will provide a weatherproof, secure, and organized storage facility for material for using units and logistic support activities.

Replacement. The QUADCON represents a new capability within the Marine Corps and does not directly replace an existing container.

Development Status. The QUADCON was designed by Rohr Industries under contract with CEL. Through a subsequent contract, Rohr Industries produced four prototypes, plus one QUADCON rack, which were delivered to CEL in the third quarter, FY80, for engineering test and evaluation.

The appointments for the QUADCON to obtain a complete container ready for employment, including locking feature, cargo tiedown fixtures, documentation receptacles, and other items, have not been detailed as yet.

Test Schedule. Development and operational testing will be combined to the extent practicable. Test and evaluation of the prototypes commenced during the fourth quarter, FY80. All development testing has been completed except the cold chamber test at Point Mugu, which is now scheduled for December 1980. Testing concentrated on laboratory analyses of a developmental nature with only limited operational evaluation. Operational evaluation will be given primary consideration during the test and evaluation of the next iteration of prototypes. These are to be procured in FY81 and will be operationally evaluated in FY82. The test results of the present first-generation prototype are discussed below for convenience of presentation rather than to indicate that they reflect development problems in general.

Development Problems. On 2 June 1980, 4 QUADCONs, with 16 commercial connectors (Line Fast Heavy Duty-TANDEMLOC Model), were shipped to the Line Fast Corporation, Montevallo, Alabama, for testing to determine whether they met ANSI/ISO standards. Testing was completed in September 1980, and the QUADCONs were returned to CEL (stored at Rohr Industries). A test report was furnished to CEL by Line Fast in early October 1980. A summary of the observed results is as follows:

- Structurally capable as a loaded single unit.
- Structurally capable when arrayed loaded up to four units.
- Only fair workmanship of steel members, including corner fittings.
- Door hinges protrude beyond the vertical plane of the container.
- Door handle and operating design preclude its easy opening and closing.
- Flooring above the tineways is subject to damage by forklift tines, even with careful handling.
- Weatherproof test failed due to water seeping through the vertical seals on the doors.
- TANDEMLOC connectors were structurally capable, though difficulty was experienced in making connections to form arrays of QUADCONs in view of the nonuniform casting of the corner fittings.
- Height of the QUADCON (6 feet, 10 inches) does not conform to the ANSI/ISO standard of 8 feet for a closed container.

Actions on the above items are being considered by CEL preliminary to acquisition of a second-generation prototype in FY81, as previously mentioned. The Line Fast Corporation indicated that the QUADCON's height would be discussed with the ISO committee that deals with such matters. Otherwise, the QUADCON meets requirements, with correction of the relatively minor quality-control-type deficiencies in fabricating the next prototype.

Quantity. The total quantity of QUADCONs required is 11,282, which is distributed as shown below. A basic quantity of 10,788 is required to house and transport organizational property and consumable supplies of MAF units. An additional quantity of 968 is needed to support the field feeding system (270), the mobile expeditionary power distribution system (MEPDIS) (204) and to meet operational readiness float and other requirements (494). With regard to the latter, the total QUADCON quantity column below reflects post D-day consumption requirements of 60 days and 180 days. For the reasons discussed under the insert, no QUADCON racks have been allocated for PWR, mobilization training, maintenance float, and other purposes. The QUADCONs allocated for general support forces and PWR are for support of the field feeding system and MEPDIS. The MAF total basic quantity of 10,788 was derived from an evaluation of the classes of supply; number of line items in each class; size and weight of the items; suitability of the items for handling and storage in the QUAD-

CON; authorization of material; and the personnel, mission, and functions of each type unit in a MAF.

	QUADCON		QUADCON Rack
FMF 60-Day Quantity			
• I MAF	2,801		121
• II MAF	2,778		118
• III MAF	2,552		106
• IV MAF	2,657		116
ORF	416		24
General Support Forces	14		
PWR	64	(108)*	
Total	11,282	(11,326)*	485

*Post D-day 180-day requirement.

Cost. Cost of the QUADCON was estimated in 1978 to be $2,000, based on the cost information provided by Rohr Industries for the PALCON. The estimate has been increased to $2,494 in terms of FY82 dollars to account for inflation at about 7 percent per year. This price may require adjustment when detailed production costs are calculated from the QUADCON final engineering design for a minimum service life of 10 years. In the same vein, the cost of the QUADCON rack is estimated to be $378. Approximately 4.3 percent of the QUADCONs will have racks for supporting inserts.

Phase-In. Since no direct replacement of containers is involved, phase-in will be governed by the time required to complete the RDT&E process, availability of funding resources, and procurement leadtime. It is anticipated that procurement will start in the third quarter, FY83, with deliveries from production continuing at a rather level rate into FY91 when provision of the QUADCON to all MAFs will be completed. The scheduled phase-in is shown below:

	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91	Total
QUADCON	1,513	1,441	1,459	1,452	1,328	1,328	1,381	1,380	11,282
QUADCON Rack	62	62	64	63	56	56	61	61	485

2.5 CONTAINER, 8'x8'x20', COMMERCIAL

Description. This is a reusable, closed, weatherproof, general-purpose cargo container for transporting and storing a number of unit loads, packages, or bulk material. It confines and protects the contents from loss or damage and can be separated from its transport mode, handled as a unitized load, and transshipped without rehandling the container contents. The commercial container may be constructed of steel, aluminum, plywood, or a combination of these and other materials which meet ANSI/ISO standards for international traffic. Its tare weight ranges from 3,600 to 4,800 pounds depending upon construction, and its cargo capacity is approximately 1,100 cubic feet or 40,000 to 41,200 pounds, for a maximum gross weight of 44,800 pounds. The commercial container has end or side doors or a combination of openings for access to the contents. The ANSI/ISO corner fittings permit handling by sling or lifting frame, restraining the containers during transport, and stacking them (normally up to six high) in containerships and other merchant vessels. It can be deck-loaded on amphibious vessels that possess a lift capability for loading and unloading. The commercial container has a tineway base to permit handling by a forklift within weight constraints, or it can be handled by sling from a crane or helicopter. Its minimum service life is estimated to be 15 years.

Replacement. This item does not directly replace any item in the current inventory.

Development Status. No development effort is assigned in view of the commercial nature of this item for lease or purchase.

Test Schedule. No testing is assigned to the commercial container itself. Rather, the container would be the load unit to be handled during the testing of vehicles, trailers, and material handling equipment (MHE) which are a part of FLS.

Development Problems. No development effort is assigned.

Quantity. The quantity of commercial containers required by lease, or by purchase as an exception to the current OSD policy, will be determined coincident with planned military operations.

Cost. If purchased as an exception to policy, the unit price of a 20-foot commercial container in terms of FY82 dollars will range from $5,244 to $5,826 depending upon its construction characteristics. If containers are leased, the cost will be about $6.70 per day per container in FY82 dollars.

Phase-In. The commercial containers could be phased into the logistics system upon receipt, contingent upon the existence of the requisite handling and transport capability.

2.6 FLATRACK CONTAINER, COMMERCIAL

Description. The flatrack is an open-side, open-top, steel, platform container with a vertical column at each corner. The top and bottom of each column have ANSI/ISO fittings to permit container handling by sling or lifting frame, restraint during transit, and stacking (normally up to six high) in containerships. It can be deck-loaded on amphibious vessels that have a lift capability for loading and unloading. The flatrack is adaptable to the unitized handling of material which is massive, oddly shaped, or of outsized dimensions. It has a tineway base to permit handling by a forklift, within weight constraints, or it can be handled by sling from a crane or helicopter. Two sizes are required for FLS. The 8'x8'x20' flatrack is needed for handling, storing, and transporting the 20'x33' and 32'x73' shelters and joining corridors. This 20-foot version has a nominal tare weight of 6,072 pounds with a cargo capacity of 1,116 cubic feet or 38,728 pounds, for a maximum gross weight of 44,800 pounds. The 40-foot version, usually with 8½-foot vertical columns, is required for the 60'x128' shelters. It has a nominal tare weight of 12,960 pounds and a cargo capacity of 2,276 cubic feet or 54,240 pounds, for a maximum gross weight of 67,200 pounds. This flatrack also has a tineway base for handling by large forklifts. It can also be handled by a crane. The minimum service life is estimated to be 25 years for each version of the flatrack.

Replacement. Flatracks represent a new capability within the Marine Corps and do not replace any existing containers.

Development Status. No development effort is assigned in view of the commercial nature of this item. While it is a commercial item, it is in extremely limited production and use in private industry and, generally, is modified for special-purpose configurations. In recognition of the scarcity of flatracks for lease from private industry, on 2 June 1980, the DC/S I&L, HQMC, submitted a request to ASD (MRA&L) to grant an exception to DODI 4500.37 and permit the purchase of flatracks commensurate with the acquisition of MCESS large shelters that they are to support. The request was approved on 11 August 1980.

Test Schedule. Limited suitability testing should coincide with the loading and transport of shelters.

As a minimum, the compatibility of packaged shelter components and standard flatracks should be physically confirmed. This effort would confirm both the dimensional compatibility and the quantity of flatracks required for each of the three types of shelters in question, as well as the joining corridor. A commercial specification should be obtained, reviewed, and modified if necessary in the acquisition process to obtain small quantities for testing.

Development Problems. No development effort is assigned.

Quantity. The quantities of flatracks recommended are shown below. These quantities will accommodate shelters and joining corridors for two MAFs. I MAF and II MAF were selected for use as a basis for the determination of quantitative requirements.

	8'x8'x20'		8½'x8'x40'	
FMF 60-Day Quantity				
• I MAF	855		360	
• II MAF	862		376	
ORF	42		21	
PWR	25	(96)*	16	(40)*
Total	1,784	(1,855)*	773	(797)*

*Post D-day 180-day requirement.

Cost. Based on an informal estimate by the Fruehauf Corporation, the cost is $6,059 for the 20-foot version and $7,274 for the 40-foot version in terms of FY82 dollars.

Phase-In. The phasing-in of flatracks should coincide with the phasing-in of shelters. It is noted, however, that shelters are being procured without concurrent provisions for flatracks. Since the FY81 budget contains no flatracks, it has been necessary to reflect procurement of flatracks beginning in FY82. An initial quantity of 410 of the 20-foot size and 75 of the 40-foot version, which are now programmed for FY82, would commence the alignment of flatrack acquisition with shelter acquisition for two MAFs. The flatrack phase-in schedule is indicated below.

	FY83	FY84	FY85	FY86	FY87	FY88	Total
8'x8'x20'	410	678	160	190	346	--	1,784
8½'x8'x40'	75	490	--	96	80	32	773

2.7 SHIPPING FRAME, 8'x8'x10'

Description. This special-purpose container is a reusable, open, metal cargo carrier with an exterior volume of 640 cubic feet and an interior volume of approximately 499 cubic feet. It has a tare weight of 2,100 pounds and a cargo capacity of approximately 7,900 pounds, or a maximum gross weight of 10,000 pounds. The container has removable framing members on four sides and ANSI/ISO standard corner fittings to permit handling and stacking in intermodal traffic. Its base possesses tineways to enable two-way handling by forklift. The frame contains floor members for the fastening of necessary fixtures to mount and restrain the 600-gph reverse-osmosis water purification unit (ROWPU) and associated equip-

ment as required for operation and movement of this unit. It is also capable of housing a variety of odd-shaped material, engines, appliances, and other assemblies by possessing those fixtures necessary to seat and restrain the candidate material during shipment. It can be handled by forklift, crane, or helicopter. The frame may be coupled in a two-array mode to form an 8'x8'x20' configuration to fit the 20-foot cells of containerships. Its minimum service life is estimated to be 10 years.

Replacement. This item does not replace any item in the current inventory.

Development Status. Development of the basic frame has been completed. It has been tested and certified as meeting ANSI/ISO standards for the marine mode. Continuing actions include determination of the types of flooring which may be needed for various applications of the frame. The current floor is about 70 percent steel grating with 2-inch square openings and 30 percent solid steel plate over tineways and bottom rail members. Arraying of two loaded frames has been performed using a commercial connector (Tandem-loc Heavy Duty Model). While some looseness was experienced and minor slippage occurred, which caused abrasions at the connecting points, the arraying test clearly established the capability to array two frames to achieve an 8'x8'x20' configuration.

Test Schedule. There are no further test activities scheduled for the frame.

Development Problems. There are no development problems.

Quantity. A total quantity of 851 frames is required. Of this quantity, 172 are required to house and transport organizational property and consumable supplies of selected combat service support units. An additional MAF-distribution quantity of 460 is needed to house the reverse-osmosis water purification units and 219 to meet operational readiness float, general support forces, mobilization training, and combat active replacement factor requirements. The total quantity below represents the post D-day 60-day requirement which is the same as the 180-day requirement.

FMF 60-Day Quantity

• I MAF	157
• II MAF	157
• II MAF	157
• IV MAF	161
ORF	88
General Support Forces	2
Mobilization Training	2
Maintenance Float	2
PWR	125
Total	851

Cost. The cost of the shipping frame is approximately $3,990 in terms of FY82 dollars for quantity production. Actual cost may vary significantly among potential suppliers. It is therefore prudent to seek wide competition during the procurement phase.

Phase-in. Phasing-in of the shipping frame should coincide primarily with the phasing-in of the 600-gph ROWPUs. The phase-in schedule is as shown below.

	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91	Total
8'x8'x10'	127	96	118	118	118	108	54	54	58	851

2.8 SHIPPING FRAME, 4'x6 2/3'x8'

Description. This special-purpose container is a reusable, open, metal cargo carrier with an exterior volume of 213.3 cubic feet and an interior volume of about 146.1 cubic feet. It has a tare weight of 1,560 pounds without floor or 1,960 pounds with floor, and a maximum gross weight of 10,000 pounds. The container has framing members on four sides and corner fittings constructed to ANSI/ISO standards to permit handling and stacking in intermodal traffic. Its tineway base allows four-way entry and handling by forklift. It may house firefighting, electric power generation, air-conditioning equipment and associated accessories, or similar equipment to provide support services in any number of operational situations. It possesses or is capable of possessing those fixtures necessary to seat and restrain the candidate material during shipment. The frame can be handled by forklift, crane, or helicopter. It may be coupled, up to a six-unit array, to form an 8'x8'x20' configuration to fit the 20-foot cells of containerships. Its minimum service life is estimated to be 10 years.

Replacement. This item does not replace any item in the current inventory.

Development Status. Development of the basic frame has been completed. It has been tested and certified as meeting ANSI/ISO standards for the marine mode. Continuing actions include determination of the types of floors which may be needed for various applications of the frame.

Test Schedule. There are no further test activities scheduled for the frame.

Development Problems. Development efforts on the frame have been completed and it is ready for service approval. However, a cubical tank that was fabricated with the frame for liquid storage did not meet international transport standards. Primary concerns rested on spillage and stability problems with a partially loaded tank. An elliptical-shaped tank is being designed to correct these problems and to comply with international standards. Since the frame is being acquired in conjunction with the tank, a delay of up to 1 year is expected

for a production contract. Such a delay would not be applicable if the frame were to be employed as a general-purpose carrier. Such a role is envisioned, but not in the immediate future.

Quantity. The total quantity of frames required is shown below. Of the 60-day quantity, 3,806 are needed to house fuel/water storage modules, pump modules, soil stabilization equipment, and firefighting equipment. The 231 remaining frames of the 60-day quantity are needed for use by combat service support units as carriers for a variety of end items, components, assemblies, accessories, and other material, plus the ORF for these units.

FMF 60-Day Quantity		
• I MAF	890	
• II MAF	859	
• III MAF	807	
• IV MAF	871	
ORF	197	
General Support Forces	92	
Maintenance Float	167	
PWR	154	(294)*
Total	4,037	(4,177)*

Cost. The cost of the shipping frame is estimated at $2,244 in terms of FY82 dollars for quantity production. This cost is based upon a survey of container manufacturers. However, in June 1979, MCDEC received a formal estimate from one manufacturer of $4,575 each for a minimum lot of six. Although this is an extremely small sample, it displays a wide variance in price quotations, consequently, it would be prudent to obtain full competition for the supply of this item during the procurement phase.

Phase-in. The phase-in schedule shown below provides for frames to house 90 soil stabilization modules (AMSS) in FY85, 90 in FY86, and 18 in FY87. The fuel/water storage modules need 326 in FY85; 326 in FY86; 156 in FY87; 158 in FY88; 156 in FY87, 90, and 91; and 1,655 in FY92 and beyond. The fuel pump module requires 53 in FY85, 46 in FY86, 90 in FY91, and 167 in FY92 and beyond. Firefighting equipment needs 82 shipping frames in FY88 and 81 in FY89. Phasing-in of 231 additional frames for general application by combat

*Post D-day 180-day requirement.

service support units is recommended in approximately equal increments from FY86 through FY90.

	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92 and Beyond	Total
4'x6 2/3'x8'	469	494	209	286	278	183	221	1,897	4,037

SECTION 3

SHELTER SUBSYSTEM

3.1 INTRODUCTION

Since 1972, the Marine Corps and other service branches have faced increasing pressure to develop standard equipment inventories which can be conveniently handled and transported by container-oriented distribution systems. Concurrently during this period, the existing Marine Corps shelter inventory, ranging from field tents to large relocatable buildings and sophisticated/dedicated vans, has deteriorated and will not adequately provide the operational characteristics required to effectively support the Fleet Marine Forces (FMF) during the mid- and long-range periods. Additionally, the existing equipment is not compatible with modern merchant containerships.

The Marine Corps Expeditionary Shelters System (MCESS) has been specifically designed to correct these deficiencies and to provide adequate environmental protection for both personnel and equipment, simplify maintenance through standardization and consistent design, and ease handling during the ship-to-shore movement and while ashore. The concept for MCESS traces its background to December 1969 when a work directive from Headquarters, Marine Corps, was issued to the Marine Corps Development and Education Command to evaluate FMF air and ground shelter requirements with the intent of reducing the number, size, and types of shelters then in the Marine Corps inventory. This study effort, completed in June 1972 when the concept for a family of seven standard shelters was briefed to the Commandant, was accepted for follow-on implementation. This resulted in the promulgation of a shelters specific operational requirement (SOR) and the initiation of a hardware development and test program in 1973. Following the fabrication, successful testing, and finalization of procurement data packages, a management plan and a development plan for execution of the shelters program were prepared in 1974; the first of several efforts to refine requirements was initiated in 1976; a required operational capability (ROC) was promulgated in 1977; the large shelters received approval for service use (MSARC III) in 1978; and the small shelters received approval to enter engineering development (MSARC II) in 1978.

Simultaneously, increasing efforts toward the standardization of shelters used by all of the services was initiated at the DOD level with the promulgation of DOD Instruction

4500.37 in 1972. This directive, in support of the standard container configuration concept, required that all future shelters and/or special-purpose vans developed to provide for an operational requirement should conform to American National Standards Institute/International Organization for Standardization (ANSI/ISO) container specifications to the maximum extent possible. Two years later in 1974, the Deputy Secretary of Defense directed that a review of all services' shelter development activities be undertaken by an ad hoc committee, which resulted in the recommendations that a Joint Committee on Tactical Shelters (JOCOTAS) be established and that the Army be designated as lead service for execution of the DOD shelters program. These recommendations were subsequently approved and resulted in the development of a formal JOCOTAS charter and the promulgation of a DOD Tactical Shelters Program Joint Regulation in 1977. This joint regulation (MCO 3920.5) directs all services to conform to ANSI/ISO dimensional and strength specifications for all tactical shelters to be developed in the future. The MCESS program is in full compliance with this joint regulation and with overall DOD policy guidelines.

Since the successful milestone review in December 1978, functional testing of large-shelter prototypes has continued, industry bids have been received for the first production procurement of large shelters, development testing of first-generation small shelter prototypes has continued, a contract for the development of second-generation small shelter prototypes has been awarded, the original gross requirements for shelters have been refined to accommodate recent force organizational changes, a shelters appointments study has been completed to provide a shopping list of standard appointments to be installed in configured shelters, and MCESS has been formally approved by the Commandant as a major subsystem in the Field Logistics System. The MCESS family consists of three large shelter types containing five shelter configurations, four small shelter types, a joining corridor, and a complexing kit.

3.2 LARGE SHELTER GROUP

The large shelter group is comprised of three sizes of relocatable prefabricated steel buildings. Each structure is formed as an assemblage of 8-foot-long foldable bay sections with endwall panels and doors to complete the building enclosure. The foldable bays and panels are framed with steel and serve as the basic structural members. These structural and intercostal members provide the support for attaching the external ribbed steel and internal corrugated facings. The space between the inner and outer panel facings is filled with fiberglass insulation and is also utilized to route and protect the factory-installed electrical wiring.

The bays, which form the hip, roof, and sidewall portions of the building are shipped as a flat-folded assembly with hinge points at the peak and eaves. Erection of the bay is accomplished by unfolding the bay, laying it on its edge, bolting the joints at the peak and eaves, then tilting the bay up to the standing position, and finally moving it into position onto the building sill plate. Adjacent bays and endwall panels are joined together by structural bolts inserted into the heavy steel frame members and sill plates. Flashing plates covering the ridge gap and all rafter and column joints are attached with spring fasteners.

3.3 SMALL SHELTER GROUP

The small shelter group is comprised of four shelter designs, a joining corridor, and a complexing kit. The four shelter designs comply with ISO requirements for shipping containers. The small shelter group replaces approximately 80 non-ISO shelter types associated with 179 table of authorized material (TAM) items in the current inventory. Complexing the knockdown and rigid general-purpose shelters in wall-to-wall and end-to-end arrangements provides open areas of 20 or 40 feet long by any multiple of 8-foot increments. All shelters can be complexed at their personnel door openings by means of a joining corridor. Additionally, both the rigid and knockdown shelter can be directly complexed side to side or end to end without a joining corridor through use of a complexing kit. Mobility in the amphibious objective area (AOA) is provided by means of logistics vehicles and helicopters. All small shelters, except the joining corridor, have two forklift tineways on the long sides.

3.4 SHELTER REQUIREMENTS

The number of shelters required by the Marine Corps was determined after an analysis of the MCESS qualitative/quantitative requirements update report of February 1979. The modifications made to the allocations contained in that report are listed below:

- The requirements structure used in the report was a notional MAF, multiplied by four. This, however, constituted only a generalized organizational representation. A more discrete depiction was obtained by using the mobilization troop list, which lists individual tables of equipment (T/Es) making up the forces and the T/E multipliers for each MAF. Shelter requirements were recomputed using the latter data.
- The MCESS summary also included those shelters which were Navy funded. These consisted of mobile maintenance facility shelters and other related shelters dedicated to aircraft maintenance. Consequently, these requirements were deleted, resulting in a reduction of more than 1,300 small shelters.

The resultant requirement for each shelter type is summarized below:

Shelter Type	Qty.
60'x128'	186
32'x73'	365
20'x33'	592
8'x8'x20' knockdown	6,114
8'x8'x20' rigid	4,762
8'x8'x20' EMI	277
8'x8'x10' EMI	984
Joining corridor	2,546
Complexing kit	5,514

3.5 SHELTER, 60'x128'

Description. This shelter, normally used as a hangar, is a prefabricated steel building constructed of hinged preassembled sections which permit rapid erection (and dismantling) on a prepared site. This shelter has two configurations: one with rollup doors in the endwalls for use in supply and storage operations and the other with sliding end doors, affording a 59-foot-wide by 20-foot-high opening for aircraft maintenance functions. The entire building is double-wall insulated and prewired with convenience outlets and lighting. The shelter can be erected by a 26-man engineer detail over a 7-day period. The detail is supplemented with other personnel for tasks such as surveying, grading, and electrical hook-ups (see appendix E for details). A crane and forklift are also required, as are hand tools.

The length of the shelter is constructed in 8-foot increments. The 16-foot-wide lean-to bays, which are halves of the 32-foot shelter, may be joined along the side walls to provide shop space. The nominal physical characteristics of the building are: length, 128 feet; width, 60 feet; and height, 25 feet at the center. It weighs 130,600 pounds and requires eight 40-foot flatracks for transport via containership.

Replacement. The 60'x128' shelter is a new addition and does not replace any existing shelter.

Development Status. The design, test, and evaluation of this shelter are complete. Included in the testing was a validation of its transportability by flatrack. A contract was awarded to Pascoe Steel on 23 September 1980 to manufacture seven shelters with an option for five additional shelters.

Test Schedule. One 60'x128' shelter was delivered to Twenty-nine Palms, California, in September 1978. It was erected and during October-November 1980 at the expeditionary airfield. Design change resulting from this erection exercise will be incorporated into future procurements.

Development Problem. Development is complete. Any further changes will be in the nature of product improvement.

Quantity. The inventory objective of 186 for the 60'x128' shelters was obtained by determining the initial issue for 4 MAFs plus the prepositioned war reserves (PWR) stocks. Recommended distribution is as follows:

FMF 60-Day Quantity		
• I MAF	45	
• II MAF	47	
• III MAF	41	
• IV MAF	49	
PWR	4	(7)*
Total	186	(189)*

Cost. The FY82 unit procurement cost is $176,400.

Phase-In. The 60'x128' shelter is recommended for phase-in in accordance with the following schedule:

	Prior FY83	FY83	FY84	FY85	FY86	FY87	FY88	OY	Total
60'x128'	19	0	57	45	12	26	23	4	186

3.6 SHELTER, 32'x73'

Description. This prefabricated steel shelter will normally be used as a maintenance or supply building. It is constructed of hinged, preassembled sections which permit rapid erection and dismantling on a graded site. This shelter has two configurations: one with rollup doors in endwalls for use in supply and storage operations and the other with four rollup doors on each side providing four maintenance bays. The entire structure is double-wall insulated and is prewired with convenience outlets and lighting. It can be erected by a 10-man engineer detail in 4 days. Except for a lifting crane and forklift, erection will not require special tools or a permanent foundation. However, grading equipment and survey personnel will be required if unimproved field sites are to be used. Electrical work for generator and wiring hookups will also require MOS 1141 assistance. (See appendix E for details.)

The shelter weighs 40,000 pounds and requires five 20-foot flatracks for transport via containership.

*Post D-day 180-day requirement.

Replacement. The 32'x73' shelter is used primarily in the supply and maintenance areas, although in a few isolated cases it may be used for operations/administration and medical functions. It replaces various maintenance tents.

Development Status. The design, test, and evaluation of this shelter are complete. Included in the testing was the validation of its transportability by flatrack. A contract was awarded to Pascoe Steel on 23 September 1980 to manufacture 42 shelters with an option for 21 additional shelters.

Test Schedule. Functional testing of the shelter was completed at Camp Lejeune and Twenty-nine Palms during 1979 and certain quality deficiency reports were prepared. Required corrections of these deficiencies have been incorporated in the ongoing procurement contract.

Development Problems. Development is complete. Any future changes will be in the nature of product improvement.

Quantity. The inventory objective of 365 for the 32'x73' shelter was obtained by determining the initial issue for the 4 MAFs plus PWR. Recommended distribution is as follows:

FMF 60-Day Quantity		
• I MAF	89	
• II MAF	89	
• III MAF	89	
• IV MAF	92	
PWR	6	(14)*
Total	365	(373)*

Cost. The FY82 unit procurement cost is $59,800.

Phase-In. The 32'x73' shelter is recommended for phase-in in accordance with the following schedule:

	Prior FY83	FY83	FY84	FY85	FY86	FY87	Total
32'x73'	100	60	56	34	36	79	365

3.7 SHELTER, 20'x33'

Description. This shelter is a prefabricated steel building constructed of preassembled sections which permit rapid erection and dismantling on a graded site. The shelter has a

*Post D-day 180-day requirement.

sliding door on one endwall which affords a 10-foot-wide opening. The building is double-wall insulated, is prewired with convenience outlets and lighting, and can be erected in 2 days by an 11-man engineer detail. Except for a lifting crane and forklift, erection will not require special tools or a permanent foundation. (See appendix E for details.)

The shelter weighs 11,643 pounds and requires two 20-foot flatracks for transport via containership.

Replacement. The 20'x33' shelters will replace various hard shelters and tents in the existing inventory.

Development Status. The design, test, and evaluation of this shelter are complete. Included in the testing was a validation of its transportability by flatrack. A contract was awarded to Pascoe Steel on 23 September 1980 to manufacture 51 shelters with an option for 41 additional shelters.

Test Schedule. Functional testing of this shelter was completed at Camp Lejeune and Twenty-nine Palms during 1979 and pertinent quality deficiency reports were prepared. Required corrections of these deficiencies have been incorporated in the ongoing procurement contract.

Development Problems. Development is complete. Any future changes will be in the nature of product improvement.

Quantity. An inventory objective of 592 for the 20'x33' shelter was obtained by determining the initial issue for the 4 MAFs plus the PWR. Recommended distribution is as follows:

FMF 60-Day Quantity		
• I MAF	152	
• II MAF	153	
• III MAF	146	
• IV MAF	131	
PWR	10	(22)*
Total	592	(604)*

Cost. The FY82 unit procurement cost is $20,900.

Phase-In. The 20'x33' shelter is recommended for phase-in in accordance with the following schedule:

*Post D-day 180-day requirement.

	Prior FY83	FY83	FY84	FY85	FY86	FY87	FY88	Total
20'x33'	187	158	92	50	27	48	30	592

3.8 SHELTER, 8'x8'x20' KNOCKDOWN

Description. The 20-foot knockdown shelter is the most widely used of all MCESS shelters. It is designed to meet a variety of shelter needs, including those associated with material storage, maintenance and repair, supply, staff operations, etc.

The roof, walls, and floor are constructed of aluminum frame. The roof has a ¼-inch plywood outer skin with fiberglass coating, paper honeycomb core, and a ¼-inch plywood inner skin. The walls have aluminum inner and outer skins and paper honeycomb cores. Flooring consists of 16 aluminum cross-pieces with 1-inch fiberglass-reinforced plywood and an aluminum outer skin. The shelter weighs 3,850 pounds and, when four units are stacked for shipment, square and cube requirements are 159 square feet and 1,109 cubic feet. With 19–22 personnel and a 6,000-pound forklift, the shelter can be erected in approximately 30 minutes. The "Small Shelter Erection Labor Analysis," dated July 1980, provides more detailed data and photographs.

Replacement. The knockdown shelter replaces both soft and hard shelters, currently in the inventory, in all functions except for chaplain and personnel support. It is used when a general-purpose MCESS shelter is appropriate; that is, when the user of the shelter does not need electromagnetic interference shielding and the shelter need not be dedicated to a specific task or function.

Development Status. First-generation prototype shelters, developed by Craig Engineering, are currently being evaluated as part of the operational test and evaluation of the Marine Corps Environment Controlled Medical System (MCEMS) and in developmental testing of the Marine Corps Field Feeding System.

Test Schedule. Present plans are to fabricate 26 second-generation shelters under the Brunswick Corporation development contract, with the majority of the prototypes assigned to MCEMS and the Electronics Maintenance Complex (EMC) for further testing during FY81–83.

Development Problems. MCEMS testing, during April 1980, disclosed several minor problems in the knockdown shelter relating to roof drainage and mating with the joining corridor. Testing of the field feeding system in July 1980 also revealed additional problems with the configuration of the complexing hardware. These problems require correction in the second-generation prototypes or as part of the final drawing package.

Quantity. An inventory objective of 6,114 for the knockdown shelter was obtained by determining the initial issue for the 4 MAFs, a training allowance, PWR and maintenance float. Recommended distribution is as follows:

	FMF 60-Day Quantity	
• I MAF	1,531	
• II MAF	1,551	
• III MAF	1,405	
• IV MAF	1,400	
ORF	69	
General Support Forces	10	
Maintenance Float	33	
PWR	115	(215)*
Total	6,114	(6,214)*

Cost. The FY82 unit procurement cost is $28,400.

Phase-In. The 8'x8'x20' knockdown shelter is recommended for phase-in in accordance with the following schedule:

	FY84	FY85	FY86	FY87	FY88	FY89	FY90	OY	Total
8'x8'x20' knockdown	142	421	858	311	411	645	862	2,434	6,114

3.9 SHELTER, 8'x8'x20' RIGID

Description. The 20-foot rigid shelter is similar to the 20-foot knockdown except that it cannot be dismantled other than sidewall panel removal for side-to-side complexing. It is the second most widely used unit of the MCESS. It can be complexed in the same way as the knockdown shelter.

The shelter tare weight is 3,850 pounds. The square and cube requirements are 159 square feet and 1,272 cubic feet. Except for a forklift, emplacement will not require special tools or equipment.

Replacement. The 8'x8'x20' rigid shelter replaces both hard shelters (vans) and tents. It is used in lieu of the EMI and knockdown shelters when the requirement for electromagnetic shielding does not exist or the shelter it is replacing is dedicated to a specific task. In the latter case, the shelter is intended for a specific function. Consequently, it will have specific integrated appointments and is denoted as being "configured." All 8'x8'x20' rigid shelters are configured.

*Post D-day 180-day requirement.

Development Status. First-generation prototype shelters, developed by Craig Engineering, are currently being evaluated as part of the operational test and evaluation for the Marine Corps Environment Controlled Medical System (MCEMS) and development testing of the Marine Corps Field Feeding System.

Test Schedule. Present plans are to fabricate 23 second-generation shelters under the Brunswick Corporation development contract, with the majority of the prototypes assigned to MCEMS and the Electronics Maintenance Complex (EMC) for further testing during FY81–83.

Development Problems. MCEMS testing during May 1980 disclosed minor problems with the joining corridor. These problems require correction in the second-generation prototypes or as part of the final drawing package.

MSARC III for the small shelters is presently scheduled for August 1981, with the initial production procurement of rigid shelters slated for FY82. Present plans are to continue operational testing using the earlier prototypes built by Craig which have been configured as part of the MCEMS. Electronics Maintenance Complex (EMC) operational testing of rigid shelters to be configured and outfitted at MCLB Albany will commence in FY83 using second-generation prototypes presently being manufactured by Brunswick.

Quantity. An inventory objective of 4,762 for the rigid shelter was obtained by determining the initial issue requirement for the 4 MAFs plus PWR. The MCEMS shelter numbers do not appear in this list since they will be procured separately. Recommended distribution is as follows:

FMF 60-Day Quantity		
• I MAF	1,209	
• II MAF	1,239	
• III MAF	1,117	
• IV MAF	1,128	
PWR	69	(174)*
Total	4,762	(4,867)*

Cost. The FY82 unit procurement cost is $30,700.

Phase-In. The recommended phase-in schedule for the 8'x8'x20' rigid shelter is:

	FY85	FY86	FY87	FY88	FY89	FY90	OY	Total
8'x8'x20' rigid	111	427	958	593	495	486	1,692	4,762

*Post D-day 180-day requirement.

3.10 SHELTER, 8'x8'x20' EMI

Description. The 20-foot EMI shelter is used when electromagnetic interference shielding is required. Designed like the 8'x8'x20' rigid shelter with the addition of shielding material, this EMI shelter will meet a variety of needs, but will be used primarily in support of applications requiring the attenuation of interfering sources of electronic and magnetic fields. The shelter weighs 4,410 pounds.

Replacement. The 20-foot EMI shelter replaces present shelters which require electromagnetic shielding and are not ISO configured.

Development Status. First-generation prototype shelters, developed by Craig Engineering, are currently being evaluated as part of the Electronics Maintenance Complex (EMC) developmental process. Changes currently being incorporated into the second-generation prototype shelters, under development by Brunswick Corporation, include the following:

- Fire-Retardant Protection. Provides for the application of a fire-retardant paint on interior surfaces and fire-retardant fiberglass on exterior surfaces in order to meet DOD flammability-retardation requirements.
- Aluminum Outer Skin. Adds an aluminum skin between the plywood floor and frame for additional EMI protection.
- Single-Door Entryway. Provides for replacement of the double door on the Craig prototype with a 36-inch single door to decrease electromagnetic leakage.
- Attenuation Improvement. Provides for a 1-inch-thick steel honeycomb core in the air vent filter of the personnel door to increase attenuation protection to 60 decibels.

Test Schedule. MSARC III for the small shelters is scheduled during August 1981. To meet the successful operational testing requirement associated with MSARC III approval, at least one of the prototype EMI shelters will undergo operational testing during the January–June 1981 time frame. This will include an evaluation of the EMI shielding level/capability before and after the prescribed testing. Shielding tests will be done at MCLB Albany and at the Brunswick facility.

Development Problems. None.

Quantity. An inventory objective of 277 for the 20-foot EMI shelter has been obtained by determining the initial issue requirements for the 4 MAFs plus PWR. Suggested distribution is as follows:

FMF 60-Day Quantity		
• I MAF	66	
• II MAF	70	
• III MAF	70	
• IV MAF	65	
PWR	6	(10)*
Total	277	(281)*

The FY82 unit procurement cost is $36,200.

Phase-In. The 8'x8'x20' EMI shelter is recommended for phase-in in accordance with the following schedule:

	FY85	FY86	FY87	FY88	FY89	FY90	OY	Total
8'x8'x20' EMI	56	33	68	94	14	--	12	277

3.11 SHELTER, 8'x8'x10' EMI

Description. The 10-foot EMI shelter is used in place of existing shelters which require electromagnetic interference shielding. It is similar to the 20-foot EMI except that it is half the size. This EMI shelter will meet a variety of needs, but will be used primarily in support of applications requiring the attenuation of interfering sources of electronic and magnetic fields. The shelter weighs 2,835 pounds.

Replacement. The 8'x8'x10' EMI shelter replaces shelters which require electromagnetic shielding and are not ISO configured. As is the case with the 20-foot EMI, these shelters are all "configured" because they will be assigned to specific tasks and will have integrated appointments.

Development Status. Same as 8'x8'x20' EMI shelter.

Test Schedule. Same as 8'x8'x20' EMI shelter.

Development Problems. None.

Quantity. An inventory objective of 984 for the 10-foot EMI shelter has been obtained by determining the initial issue requirements for the 4 MAFs plus PWR. Suggested distribution is as follows:

*Post D-day 180-day requirement.

FMF 60-Day Quantity		
• I MAF	236	
• II MAF	255	
• III MAF	243	
• IV MAF	237	
PWR	13	(33)*
Total	984	(1,004)*

Cost. The FY82 unit procurement cost is $26,300.

Phase-In. The 8'x8'x10' EMI is recommended for phase-in in accordance with the following schedule:

	FY85	FY86	FY87	FY88	FY89	FY90	OY	Total
8'x8'x10' EMI	53	225	206	323	21	--	156	984

3.12 JOINING CORRIDOR

Description. The joining corridor is used to connect shelters at their personnel door openings and thereby enhance the versatility of the shelter subsystem. The 7'x7'x11' corridor contains four access openings, one on each side. A removable solid panel and a removable double door panel interchange in any of the openings. The corridor contains a flexible shroud assembly which provides a weatherproof seal between the corridor and the shelter through adherence to the velcro strips bordering the door frames of both the corridor and small shelters.

The roof, walls, and floor are constructed of aluminum extrusions with polystyrene foam cores and three-piece aluminum skins. In its transport mode, the corridor folds into a transport envelope covering 78.8 square feet and 70.6 cubic feet. It can be transported either stacked without the use of a flatrack or in quantities up to 8 in an 8'x8'x20' flatrack. The corridor weighs 660 pounds and can be erected by an 8–10-man crew in approximately 12 minutes.

Replacement. The joining corridor does not replace any existing item.

Development Status. First-generation prototype corridors, developed by Craig Engineering, are currently being evaluated as part of the operational test and evaluation of the Marine Corps Environment Controlled Medical System (MCEMS). Second-generation prototype corridors are presently being fabricated by the Brunswick Corporation.

*Post D-day 180-day requirement.

Test Schedule. Present plans are to test the second generation prototype corridor as part of the MCEMS testing at Camp Lejeune during FY81.

Development Problems. MCEMS testing during May 1980 disclosed that when the rigid and knockdown shelters were connected to the corridor, the double doors of the shelter could not be fully opened into the corridor because of the limited width of the corridor access panel opening. Consideration is currently being given to either widening the corridor opening or changing the rigid/knockdown shelter double doors to a 36-inch single door similar to the door in the EMI shelters.

Quantity. The inventory objective of 2,546 for the joining corridor has been obtained by determining the amount required for initial issue to the 4 MAFs plus PWR. Recommended distribution is as follows:

FMF		
• I MAF	636	
• II MAF	643	
• III MAF	602	
• IV MAF	625	
General Support Forces	5	
PWR	35	(90)*
Total	2,546	(2,601)*

Cost. The FY82 unit procurement cost is $13,100.

Phase-In. The joining corridor is recommended for phase-in in accordance with the following schedule:

	FY84	FY85	FY86	FY87	FY88	FY89	FY90	OY	Total
Joining corridor	24	285	573	256	175	178	282	773	2,546

3.13 SMALL SHELTER COMPLEXING KIT

Description. The complexing kit consists of a set of external flashings, interior covers, and floor plates which provide a weatherproof seal along the roof, vertical columns, and floor joints to permit direct complexing of a knockdown or rigid shelter with similar shelters, both side to side and end to end. Any number of knockdown and rigid shelters may thus be complexed by omitting interior walls or door end panels into an array up to two shelters long (40 feet) by any number of shelters in width (multiples of 8 feet).

Replacement. The complexing kit does not replace any existing item.

*Post D-day 180-day requirement.

Development Status. Kit components fabricated by Craig Engineering are currently being evaluated incident to the complexing of rigid and knockdown shelters associated with operational test and evaluation of the Marine Corps Environment Controlled Medical System (MCEMS) and the Marine Corps Field Feeding System. Additional kits/components are presently being fabricated by Brunswick Corporation incident to the development of second-generation prototype shelters.

Test Schedule. Testing of complexing kits fabricated by Brunswick Corporation will be accomplished incident to follow-on testing of second-generation prototype rigid and knockdown shelters during FY81.

Development Problems. Operational testing of MCEMS and the field feeding systems during 1980 revealed that some of the complexing kit components used for side-to-side shelter complexing are approximately 20 feet in length and that the kit is packaged in a 20-foot-long wooden box. Consideration is being given to reassembling the 20-foot parts into 10-foot parts and redesigning the package to make it easier to handle and control. Consideration is also being given to making the kit an integral assemblage attached to or contained within the rigid shelter.

Quantity. An inventory objective of 5,514 complexing kits has been established to fulfill the planned direct-complexing requirements for rigid and knockdown shelters. Recommended distribution is as follows:

FMF	
• I MAF	1,359
• II MAF	1,376
• III MAF	1,353
• IV MAF	1,345
General Support Forces	5
PWR	76
Total	5,514

Cost. The FY 82 unit procurement cost is $4,600.

Phase-In. The complexing kit is recommended for phase-in in accordance with the following schedule:

	FY84	FY85	FY86	FY87	FY88	FY89	FY90	OY	Total
Complexing Kit	71	445	910	454	428	552	631	2,023	5,514

3.14 APPOINTMENTS

Description. Shelter appointments consist of equipments, racks, benches, shelves, desks, chairs, etc., to be outfitted within the 8'x8'x20' rigid shelters and the EMI shelters.

Replacement. The permanently affixed appointments/equipments will replace all non-standardized existing appointments.

Development Status. The identification of appointments/equipments to be installed in the rigid shelters assigned to the Marine Corps Environmental Controlled Medical System (MCEMS) has been completed and MCEMS-configured first-generation prototype shelters were operational tested at Camp Lejeune. Additionally, efforts are ongoing to identify the appointments which will be installed in the rigid and EMI shelters assigned to the Electronics Maintenance Complex (EMC), the Marine Integrated Fire and Air Support System (MIFASS), engineer shop sets, and motor transport shop sets. A requirements study was completed by MCDEC in 1978 which identifies approximately 108 different appointment items, most of which are commercially available.

Test Schedule. There are no present plans to procure test shelter appointments other than those installed in the MCEMS and EMC complexes.

Development Problems. Present plans call for MCLB, Albany to accomplish outfitting of rigid and EMI shelters in the same manner as the current effort on the MCEMS prototype shelters. However, because of the large number of shelters to be outfitted and the estimated 65–85 different shelter configurations required, some of this effort may have to be assigned to independent contractors if the planning goal of 1-year duration from delivery of production shelters to MCLB, Albany through completion of their outfitting is to be accomplished. In view of the large number of rigid and EMI shelters scheduled for procurement in FY82 and the fact that the total inventory objective of such shelters must be configured, a detailed coordination plan should be developed for this outfitting effort prior to MSARC III for the small shelters, and its phasing should be based on appendix D (Shelter Introduction Plan) to the Master Implementation Plan of the Marine Corps Field Logistics System.

Quantity. Detailed design is required for each installation before appointment types and quantities can be determined.

SECTION 4

MOTOR TRANSPORT SUBSYSTEM

4.1 INTRODUCTION

In the motor transport field, the Marine Corps faces a distinct challenge in meeting its wheeled transportation requirements for the present and future. The tactical and logistical vehicle fleet must not only fulfill its present-day missions of transporting personnel, weapons, communications equipment, and general cargo, but also meet the demands of the future, primarily the movement of shelters and cargo containers conforming to ANSI/ISO specifications. Further, it must be capable of operating in the varied climatic and terrain conditions of the world to which the Marine Corps may deploy.

In this regard, the Marine Corps plans to use a smaller number of higher capacity vehicles. These would fulfill motor transport requirements, yet offer a reduction in the total number and variety of vehicles now required. Reducing the quantity and number of vehicle types in the Marine Corps inventory creates the opportunity for associated reductions in operator and maintenance personnel, logistics requirements, and training.

The motor transport subsystem of the FLS will provide the needed capability while standardizing the vehicle fleet with fewer numbers and types of vehicles. The subsystem presently consists of eight proposed types of vehicles or adaptations to replace the majority of the existing vehicle inventory. Four powered vehicles, three trailers, and a transporter comprise the FLS motor transport subsystem. These vehicles are defined in ROC No. LOG 1.36 covering the Tactical Vehicle Fleet (TVF) and are as follows:

- High-mobility multipurpose wheeled vehicle (HMMWV)
- Heavy high-mobility tactical truck (HHMTT)
- Medium prime mover
- Heavy prime mover
- Logistics trailer, 12½-ton
- Logistics trailer, 22½-ton
- Mobilizer/transporter (not identified in ROC No. LOG 1.36)
- Semitrailer, 65-ton

Recommended quantities of each type of vehicle have been determined upon the premise of maintaining current mobility capabilities within combat and combat support units,

as well as maintaining or increasing the transport capacity within combat service support units. An evaluation of specific tactical vehicle requirements has been initiated. This evaluation could modify the currently planned requirements based upon new mission assignments and the introduction of other new equipment.

High-Mobility Multipurpose Wheeled Vehicle. This small tactical truck has been designed for maximum cross-country capability to meet the high-mobility requirements of combat and combat support units. It will replace all ¼-, ½-, 3/4-, and 5/4-ton trucks of the existing fleet, including all variations thereof, i.e., ambulance, cargo truck, personnel carrier, communications truck, utility truck, etc. The associated small trailers (¼- and 3/4-ton) which are towed by the current trucks will also be eliminated. The new HMMWV will have a payload capacity of at least 5/4 tons. Replacement of tactical vehicles will be on a one-for-one basis except in organizations which can retain sufficient transport capability with a slightly reduced number of vehicles due to the increased capacity of the new vehicle.

Heavy High-Mobility Tactical Truck. This truck will replace all 2½- and 5-ton class trucks except for those 5-ton cargo trucks which will be replaced in certain instances by tractor/trailer combinations. The new 5-ton truck will replace the existing 2½-ton and 5-ton trucks on a one-for-one basis in combat and combat support units. In combat service support units, consideration has been given to the hauling and unit mission requirements. Accordingly, some 5-ton trucks have been replaced by the medium prime mover and the 12½-ton logistics trailer.

Medium and Heavy Prime Movers. Two prime movers will tow the three classes of trailers in the motor transport fleet. They will replace the present 5- and 10-ton classes of truck-tractors. The prime mover replacement criteria is dictated by the number of trailers which will be required to fulfill mission requirements. The medium prime mover will tow the 12½-ton trailer, while the heavy prime mover will tow the 22½-ton trailer and the 65-ton semitrailer. However, any further development in the medium prime mover will be held in abeyance pending the developmental/operational testing of the heavy prime mover. As the result of those tests, a decision will be made regarding the need for a medium prime mover and whether the current 5-ton tractor and 12-ton semitrailer will fill that need if it exists.

Trailers (12½-Ton and 22½-Ton). These trailers will replace the majority of trailers and many of the trucks in the current Marine Corps inventory. The 12½-ton and 22½-ton trailers will be dimensionally standardized for compatibility with all ANSI/ISO configured equipment including containers, shelters, and modules while still maintaining the capability to transport breakbulk cargo. The criteria used for the replacement of existing trailers with 12½-ton and 22½-ton trailers is based on achieving an equal or greater capability for trans-

porting cargo where tonnage and shipping square parameters are considered. The basic objective is to increase asset utility, thereby improving productivity.

Depending upon the outcome of the heavy prime mover testing, a decision will be made regarding the requirement for a 12½-ton trailer. The rationale for this decision is provided in the preceding paragraph.

Mobilizer/Transporter. This item is a recent addition to the FLS system. This vehicle will be the primary means of transporting that equipment housed in 40-foot flatracks. This item could consist of one of two configurations. The first candidate could be a mobilizer which attaches to the corner fittings of the ANSI/ISO compatible containers/shelters. The other could be the standard M872 34-ton, 40-foot semitrailer. In the event that the latter vehicle were selected, it is compatible with the heavy prime mover. A ROC, a project work directive, and a request for RDT&E funds must be initiated in order to pursue further development on this item.

Semitrailer (65-Ton). This vehicle will be utilized to transport tanks, heavy equipment and oversized loads during on- and off-road operations. It will be towed by the heavy prime mover. Another size semitrailer will be retained in the current inventory, because of its recent acquisition, to supplement the 65-ton semitrailer to haul medium-size equipment. This 40-ton semitrailer, which will also be towed by a heavy prime mover, is not presently considered part of the FLS.

The proposed vehicle system with the dimensionally standard trailer (8'x20') offers the flexibility for transporting equipment in modular form. This will eliminate dedicated vehicles for such equipment. Examples of this application are the following types of new equipment configured to ANSI/ISO modular specifications:

- Fuel/water storage and pump modules to replace water and fuel-carrying trucks and trailers.
- A dump module to replace 5-ton dump trucks in force engineer units.
- Firefighting modules.

In addition, other equipment types, some of which have previously been trailer-mounted, are being designed in modular form and would be transported when required by TVF trailers. These include the following:

- Water purification unit
- Marine Corps Field Feeding System
- Refrigeration unit
- Bakery system
- Soil stabilization unit
- Bulk laundry unit
- Sanitation unit

- Combined laundry and bath unit
- Bath/shower unit
- Lubrication service unit
- Steam cleaner unit

The shelter system, a companion subsystem of the FLS, offers the potential for further vehicle reductions through the replacement of maintenance and other types of vans currently mounted on dedicated trucks or trailers. Under the FLS concept, these shelters would be transported by the new trailers only when movement is necessary. Initial analysis suggests, however, that this requirement could be considerable based upon current shelter quantities.

The foregoing advantages inherent in the TVF make its early acquisition highly desirable. However, the current state of development of these vehicles and the vagaries of defense budgets dictates the continued prudent use and critical management of current tactical and logistics support vehicles during the transition period to the TVF.

Opportunities for reduction in quantities of vehicles were sought in developing inventory objectives. Reductions were made where it appeared that excessive increases in transport capability had resulted from application of conceptual vehicle mix analysis (CVM) replacement factors. Attention was given to maintaining unit mobility consistent with its stated mobility characteristics. Where feasible, heavier motor transport items were moved from combat and combat support units and reallocated to motor transport units within the same major command.

A basic guideline followed in making recommendations for vehicle allocations was to give each unit sufficient resources to perform its mission on a normal basis but below expected peak load levels. This requires the efficient utilization of organically assigned vehicles and supplementary assistance from motor transport units for peak load requirements. This philosophy of vehicle allocation, although demanding judicious management, will ensure the optimal use of available motor transport assets.

The bulk of the motor transport fleet consists of both tactical and logistics vehicles. However, there are other distinct vehicles which will be retained in the inventory. These are either of recent acquisition, are mission dedicated, or are neither technically nor economically feasible to eliminate from the motor transport inventory at this time.

In summary, the motor transport subsystem provides the capability to meet present and future requirements while providing for substantial savings through equipment standardization with fewer types of vehicles, greater item utilization through the elimination of dedicated vehicles, and increased throughput efficiency by use of larger capacity vehicles.

Further savings in motor transport assets will result from pooling logistics-type vehicles in motor transport units for maximum utilization.

4.2 HIGH-MOBILITY MULTIPURPOSE WHEELED VEHICLE (HMMWV)

Description. This vehicle is a new multipurpose high-mobility truck (4x4) with a capacity of at least 5/4 tons, and it is currently being developed by the Army through a joint service agreement. The vehicle will be a general-purpose type for radio communications, weapons carrier, utility cargo, personnel transport, and ambulance applications. It is the smaller of two highly mobile tactical trucks to be utilized by combat and combat support units under the FLS concept. The vehicle will have a diesel engine with an automatic transmission. It will be capable of accommodating different weapon support systems as well as transporting 1.25-ton loads cross country. A prime feature of the design is that approximately 80 percent of its components will be commercial items.

Replacement. The HMMWV will replace all existing ¼-, ½-, 3/4-, and 5/4-ton trucks and associated ¼- and 3/4-ton trailers. Included in these classes are ambulances and those vehicles in which light radio sets are installed. A listing of the vehicles to be replaced and specific schedules for replacement are addressed in chapter 3 of this master plan.

Development Status. Several prototype vehicles in the 5/4-ton payload range have been under consideration by the Army. A model built by the Chrysler Corporation was evaluated by the Marine Corps in 1978 and judged to be representative of the type of vehicle needed for the light high-mobility tactical role. Development and evaluation of this series of vehicles was suspended by the Army but resumed in April 1979. A Joint Mission Element Need Statement (JMENS) was signed during July 1980 setting forth the joint requirement for a HMMWV. The Marine Corps is continuing to support the Army in their effort to obtain congressional support for this item.

Test Schedule. Competitive runoff tests of prototype vehicles are scheduled by the Army to be completed during third quarter FY82. Based on the foregoing, operational tests by the Marine Corps are slated to be completed by the fourth quarter of FY82.

Development Problems. Effort to prosecute a Joint Service Acquisition Program have been underway for more than 2 years. Results of these efforts have not significantly advanced the HMMWV program. Marine Corps involvement in this program has been intense both in the area of resources and funds. At this point, Army efforts have failed to obtain congressional support for program funding. A cause for this failure could be the lack of credibility because of several issues surfaced within various Army commands pertaining to the basic HMMWV requirement. There is also a perception by Congress that the Army has failed to implement a mandate to substitute certain tactical vehicles with off-the-shelf

commercial items. Further adding to this dilemma is a requirement levied upon the Army to encourage small business involvement. As a result, the chance of gaining congressional approval during calendar year 1980 is extremely doubtful.

Meanwhile, each day of delay in starting the program will be directly translated to a delay in introducing the vehicle into the Marine Corps. It would appear that the inertia of the program, congressional reluctance, small business involvement, and nonurgency of Army requirements may necessitate a change in program management. One approach would be to switch the lead-service role to the Marine Corps where the urgency of the requirement could provide the driving force for executing the developmental program.

Quantity. Recommended quantities for POM 83 have been based on a continuing analysis of requirements, changes in force structure, and maritime prepositioned ships (MPS). Adjustments were made to maximize the overall efficiency of the FLS in accordance with guidelines stated by cognizant sections within HQMC.

The inventory objective of 9,980 for the HMMWV has been obtained for initial planning purposes by determining the initial issue quantities for each MAF using the mobilization troop list data for actual T/E structure and location, with the addition of float, and PWR assets as shown:

FMF 60-Day Quantity		
• I MAF	2,197	
• II MAF	2,084	
• III MAF	1,767	
• IV MAF	2,064	
ORF	317	
Maintenance Float	319	
Mobilization Training	12	
General Support Forces	352	
PWR	868	(2,104)*
Total	9,980	(11,216)*

Cost. The average cost of the HMMWV (considering all body configurations) is estimated to be $22,000. This is based on information received from the Army's Tank Automotive Command (TACOM).

*Post D-day 180-day requirement.

Phase-In. The HMMWV is scheduled for phase-in as shown below.

	FY84	FY85	FY86	FY87	FY88	FY89	Total
HMMWV	414	2,912	2,075	1,790	1,812	977	9,980

4.3 HEAVY HIGH-MOBILITY TACTICAL TRUCK (HHMTT)

Description. This vehicle is a tactical truck having a load capacity of approximately 5 tons and will be used by all FMF units. Due to current inventory replacement needs and the likelihood of a lengthy development period for a conceptual vehicle, the M939 series, product-improved 5-ton will be procured as the candidate HHMTT. It will provide the capability to transport general cargo and troops. It will also be the prime mover for the M198 howitzer.

Replacement. The new HHMTT truck will replace the existing $2\frac{1}{2}$-ton and 5-ton trucks. Specific details of vehicles being replaced are provided in chapter 3 of this master plan.

Development Status. The Army completed development and type classified the M939 series as a product improvement program (PIP) version of the existing M809 series 5-ton truck. The Army had expected to buy 1,600 of these vehicles in FY79 with a contract award scheduled for the end of that year. The Marine Corps would have participated in the vehicle buy. However, Congress denied the Army procurement approval. Consequently, the Marine Corps began procurement of the M809 series vehicle to meet immediate needs. Subsequently, in June 1980, Congress did authorize the Army to procure the M939 series vehicle. The requirement continues for a true HHMTT in the 4- to 5-ton payload range that will provide a more versatile performance than that afforded by the M809/M939 series truck. Any developmental efforts in this area by the Army will be closely monitored by the Marine Corps.

Test Schedule. None currently required.

Development Problems. Recent congressional action has complicated things for the Marine Corps, as it is anticipated that initial delivery of the M939 series vehicles will take place 18–24 months after contract award. This delivery slippage will delay replacing the current aging M35/M54 fleet. The currently planned IOC for the M939 series will be achieved in September 1982. As a result, a M54 retrofit program (M809 series) has been investigated and funding requirements have been identified. In the event that the retrofit program becomes a reality, the quantities of M939 series vehicles being procured will be reduced accordingly.

Quantity. Quantities for the HHMTT were determined by a review of the present allocation of similar vehicles to organizations in the FMF. Consideration was given to the recommendations of the CVM analysis and subsequent reviews.

The CVM analysis replaced existing 2½-ton cargo trucks with 4-ton HHMTTs on a one-for-one basis in combat units. It also recommended 897 4-ton cargo trucks for the notional MAF. This number included 57 trucks configured as wreckers and 16 as firefighting vehicles.

The CVM analysis recommendation of 4-ton cargo trucks to each organization was reviewed to the company/battery/squadron level. These vehicles replaced 2½-ton and 5-ton cargo trucks on a one-for-one basis in each organization, unless excessive cargo-carrying capacity was determined in the review. In such cases, some vehicles were reassigned to a motor transport unit within the parent command. The purpose of this reallocation was to increase utilization of vehicles by pooling assets. However, sufficient vehicles were retained in units to fulfill basic mobility requirements, as authorized in Tables of Organization.

The requirements for wreckers were reviewed in light of the reduced density of trucks. As a guideline, a wrecker was left in each unit which had an allocation of wreckers, provided that at least 50 HHMTTs remained in the unit. Units having a high truck density were allocated wreckers on a basis of 1 per 100 vehicles. Wreckers in excess of these guidelines were eliminated. An analysis of vehicle distribution resulted in a recommendation that wreckers be concentrated primarily in motor transport units and at motor transport maintenance facilities. Other wreckers were provided where the concentration of vehicles warranted an organic recovery capability. Future requirement studies should reevaluate the present wrecker distribution.

An inventory objective of 3,982 cargo trucks, 246 wreckers, 239 extra-long wheelbase (XLWB), and 172 dump trucks has been obtained for planning purposes by determining initial issue quantities for each MAF, using the mobilization troop list data for actual T/E structure and location, plus other assets as shown:

	5-Ton Cargo		5-Ton Wrecker		5-Ton XLWB		5-Ton Dump	
FMF 60-Day Quantity								
• I MAF	847		53		55		27	
• II MAF	780		52		55		27	
• III MAF	623		46		55		27	
• IV MAF	810		52		55		27	
ORF	160		8		4		24	
General Support Forces	288		9		--		2	
Maintenance Training	2		--		--		1	
Maintenance Float	122		10		--		31	
PWR	350	(875)*	16	(48)*	15	(46)*	6	(15)*
Total	3,982	(4,507)*	246	(278)*	239	(270)*	172	(181)*

*Post D-day 180-day requirement.

Cost. The FY82 unit cost for the cargo truck is $65.6K, the wrecker is $124.7K, the XLWB is $73.6K, and the dump truck is $73.6K.

Phase-In. The HHMTT is scheduled for phase-in as shown below.

	FY79	FY80	FY81	FY82	FY83	FY84	FY85	FY86	Total
Cargo	405	--	271	793	492	484	627	910	3,982
Wrecker	49	--	--	69	86	42	--	--	246
XLWB	13	--	14	54	63	61	34	--	239
Dump	--	--	--	--	27	52	93	--	172

4.4 MEDIUM PRIME MOVER

Description. This vehicle is a diesel-powered prime mover designed to tow the 12½-ton logistics trailer. It will be capable of on- and off-road travel, including highway speeds of 45 mph and will be capable of towing weapons. The vehicle will be utilized primarily by combat service support units.

Replacement. The vehicle will replace some of the existing 5-ton truck-tractors and, in conjunction with the 12½-ton trailer, some of the 5-ton cargo trucks.

Development Status. The Marine Corps has solicited the heavy automotive and construction equipment industry to identify suitable commercial or modified commercial vehicles which could meet Marine Corps needs. Proposed performance specifications were disseminated to and have been reviewed by interested companies. Their comments were considered in the formulation of purchase descriptions for prototypes initially planned to be

procured in FY81. However, recent developments, as listed below, have resulted in modifications to the medium prime mover development schedule.

Test Schedule. Testing of an earlier prototype was conducted at Aberdeen Proving Ground but was terminated due to trailer design deficiencies. Further testing of any item to fill this requirement will be held in abeyance until the results of the heavy prime mover and logistics trailer testing are known.

Development Problems. The military feasibility of using industrial-type rubber-tired tractors in combination with wagon-type trailers (12½-ton and 22½-ton) for transporting heavy loads and containers over various types of terrain requires demonstration and the development of employment procedures. Pending the results of the heavy prime mover and logistics trailer tests, further testing of this item is being withheld. It is possible that an adaptation of the heavy prime mover may meet the medium prime mover requirement.

Quantity. The quantity of medium prime movers was determined by an analysis of the CVM recommendations along with an analysis of the present assets allocated to a baseline MAF, utilizing the mobilization troop list data. A major factor in determining the allocation of these vehicles was to ensure sufficient quantities to tow the 12½-ton trailers.

Generally, medium prime movers were not allocated to highly mobile tactical units of the Marine Division. Logistics trailers and their associated prime movers allocated to the units of the Marine Division were assigned to the Truck Company of the Headquarters and Service Battalion to improve the effective utilization of these high-capacity vehicles. An exception is the artillery units which have heavy motor transport equipment.

Medium prime movers were allocated on the basis of one prime mover to two 12½-ton logistics trailers. An exception is in the Marine Air Wing where 5-ton trucks are capable of towing 12½-ton trailers at airfields and on level roadways.

Analysis of the employment of a medium dump module to be hauled on a 12½-ton trailer proved to be technically impractical. Therefore, a recommendation has been made by CG, MCDEC that the 5-ton dump truck be retained as an item in the motor transport system. Headquarters, Marine Corps, has approved the recommendation, and the 5-ton dump truck, M930, will be retained in the motor transport subsystem.

An inventory objective of 541 has been obtained for planning purposes by determining the initial issue for each of the 4 MAFs using the mobilization troop list data for actual T/E structure and location with the addition of float and PWR assets as shown:

FMF 60-Day Quantity		
• I MAF	125	
• II MAF	123	
• III MAF	123	
• IV MAF	125	
General Support Forces	4	
Maintenance Float	13	
PWR	28	(73)*
Total	541	(586)*

Cost. The cost of the medium prime mover is estimated to be $64,200 in terms of FY82 dollars. This estimate was obtained from a survey of companies experienced in manufacturing such items and is based on a production procurement in excess of 100 per year. The cost is for the basic tractor only and does not include the cost of any accessories such as winch, crane, or forklift.

Phase-In. The medium prime mover is scheduled for phase-in as shown below.

	FY86	FY87	FY88	FY89	Total
Medium prime mover	127	130	140	144	541

4.5 HEAVY PRIME MOVER

Description. This vehicle will be used primarily to tow the 22½-ton logistics trailer. It will be diesel-powered and capable of on- and off-road operations, with the ability to attain highway speeds of 45 mph. It will be used mainly in logistic support areas and in line haul operations.

Replacement. This vehicle replaces two types of 10-ton truck-tractors and a portion of the 5-ton truck-tractor inventory. Specific listings and schedules are cited in chapter 3 of this master plan.

Development Status. The Marine Corps solicited the heavy automotive and construction equipment industry to identify suitable commercial or modified commercial vehicles which could meet Marine Corps needs. Proposed performance specifications were disseminated to and reviewed by interested companies. Their comments were considered in the formulation of purchase descriptions for prototypes.

The RFP was issued and proposals were received 30 June 1980. The proposals underwent both a technical review and source selection council review. The source selection council recommended only one system, the prime mover and powered trailer, as a candidate

*Post D-day 180-day requirement.

system. The selection of only one system was based upon the nonresponsiveness of proposals submitted by industry.

Test Schedule. Testing of an earlier prototype was conducted at Aberdeen Proving Ground but was terminated due to trailer design deficiencies. Tests will resume using new prototypes in the third quarter of FY81. The purpose of the tests will be to validate the prime mover/trailer concept and provide a performance comparison of design vehicles with in-service Army baseline vehicles (M818, M871, M872).

Development Problems. None.

Quantity. The quantity of these vehicles recommended for initial issue has been determined by an analysis of the CVM recommendations along with an analysis of the present assets allocated to a baseline MAF utilizing the mobilization troop list data.

Allocation of these vehicles was made on the basis of one heavy prime mover to two 22½-ton logistics trailers. An exception is in the case of the 15-cubic-yard dump modules in the Engineer Support Battalion and the Wing Support Group where prime movers are allocated on a one-for-one basis with the trailers used to transport these modules. The majority of these high-capability vehicles, along with the associated 22½-ton trailers, have been concentrated in the motor transport units for efficient utilization in meeting the total needs of the MAF.

The heavy prime mover replaces 10-ton truck-tractors on a one-for-one basis in those units where they are utilized as prime movers for the 40-ton semitrailer and the 65-ton tank transporter semitrailer. Under the CVM concept, all semitrailers will be towed by the heavy prime mover modified to accommodate those semitrailers. In the Maintenance Battalion, a total of four modified heavy prime movers will replace the four 10-ton truck-tractors currently used as prime movers for the 65-ton tank transporter semitrailer.

An inventory objective of 526 for these vehicles, including the modified version, has been obtained for planning purposes by determining the initial issue quantities for each MAF using the mobilization troop list data for actual T/E structure and location, plus other assets as shown:

FMF 60-Day Quantity		
• I MAF	117	
• II MAF	117	
• III MAF	117	
• IV MAF	117	
ORF	12	
General Support	1	
Maintenance Float	12	
Mobilization Training	1	
PWR	29	(70)*
Total	523	(564)*

Cost. Cost of the heavy prime mover is estimated to be $109,300 in terms of FY82 dollars, based on a production procurement in excess of 100 per year. The cost is for the basic tractor unit only and does not include accessory equipments.

Phase-In. The heavy prime mover is scheduled for phase-in as shown below.

	FY84	FY85	FY86	FY87	FY88	Total
Heavy prime mover	100	110	110	102	101	523

4.6 LOGISTICS TRAILER (12½-TON)

Description. This vehicle will be either a semitrailer or a powered trailer with an 8'x20' flatbed provided with twist-lock receptacles to handle 20-, 10-, and 6 2/3-foot-long containers, shelters, or modules. The trailer will possess a nominal payload capacity of 12½ tons. It will normally be towed by the medium prime mover; however, the semitrailer with a dolly converter could also be towed by the 5-ton truck under less than full loads and good operating conditions. The 8'x20' dimensions of the trailer will permit its stowage in the cell of a containership.

Replacement. The 12½-ton logistics trailer will replace most trailers in the intermediate payload range. Specific vehicles and schedules are provided in chapter 3 of this master plan.

Development Status. A prototype 12½-ton logistics trailer was partially tested at Aberdeen Proving Ground for FLS feasibility. It was a modified version of a trailer originally designed for the transport of the standard Marine Corps shelters. The self-load/unload and adjustable bed height features of the original design were eliminated and the trailer was redesigned to accommodate 12½ tons. However, the redesigned trailer did not complete

*Post D-day 180-day requirement.

testing due to structural deficiencies. No further action regarding this item is planned until the results of the heavy prime mover and 22½-ton trailer testing have been reviewed.

Test Schedule. Feasibility testing of the CMI-Load King 12½-ton logistics trailer and the medium prime mover was terminated due to trailer inadequacies. Feasibility testing of a new trailer prototype is being held in abeyance.

Development Problems. The feasibility testing at Aberdeen was halted because of design inadequacies and material failures on the trailer during the initial portion of cross-country mobility tests. These failures included a cracked frame, extensively damaged wheel rims, and scuffing of the wheels on the trailer bed while traversing bumps. The spring suspension system proved inadequate for the load and terrain. Other less essential features that required improvement included a provision for larger brakes, brake actuator fitting boot caps, and a lengthened trailer tongue. A further beneficial modification would be the placement of container guides at each trailer corner to facilitate container positioning precisely over the ANSI/ISO locking devices.

Quantity. The quantity of 12½-ton logistics trailers has been determined by an analysis of the present assets allocated to a baseline MAF utilizing the mobilization troop list data as well as an analysis of the CVM study recommendations.

During the analysis of 12½-ton logistics trailer requirements, there was concern about the ability of units to transport water and fuel modules with the number of trailers provided. It was determined that a 1,000-gallon water or fuel module can be transported on the 5-ton truck, thereby providing considerable flexibility to the smaller units in transporting these commodities.

A 12½-ton logistics trailer inventory objective of 1,040 has been obtained for planning purposes by determining the initial issue for each MAF, using the mobilization troop list data for actual T/E structure and location, plus other assets as shown:

FMF 60-Day Quantity		
• I MAF	225	
• II MAF	221	
• III MAF	221	
• IV MAF	225	
ORF	12	
General Support	70	
Maintenance Float	15	
PWR	51	(128)*
Total	1,040	(1,117)*

*Post D-day 180-day requirement.

Cost. Cost of the 12½-ton logistics trailer is estimated to be $14,800 in terms of FY82 dollars.

Phase-In. The 12½-ton logistics trailer is scheduled for phase-in as shown below:

	FY86	FY87	FY88	FY89	Total
12½-ton logistics trailer	254	265	275	246	1,040

4.7 LOGISTICS TRAILER (22½-TON)

Description. This vehicle will be either a semitrailer or a powered trailer with an 8'x20' flatbed configuration with ISO twist-lock receptacles for 8-, 10-, and 20-foot-long containers, shelters, or modules. It has a nominal load capacity of 22½ tons and will be towed by the heavy prime mover.

Replacement. The 22½-ton logistics trailer will replace the 25-ton low-bed semitrailer and the 12-ton semitrailer.

Development Status. A prototype 22½-ton logistics trailer has undergone partial feasibility tests at Aberdeen Proving Ground. It is a modified version of a trailer originally designed for Marine Corps shelter transport. Like the 12½-ton logistics trailer, the self-load/unload and adjustable bed height features of the original design were eliminated in the second version and the trailer was specifically designed to accommodate 22½ tons.

As a result of this testing, industry was requested to comment on a proposed performance description and, subsequently, an RFP was issued. Ten responses were received from industry, each of which underwent a technical review by TARADCOM. A source selection council was convened to review the proposals along with the results of the technical review. Of the three concepts represented in the proposals (semitrailer, full trailer, and powered trailer) only the powered trailer was selected by the source selection council.

Test Schedule. As previously noted, feasibility testing of the trailer at Aberdeen was terminated due to trailer failures/inadequacies. Testing will be resumed when a new trailer prototype becomes available in FY81.

Development Problems. The feasibility testing at Aberdeen uncovered several hardware failures and design inadequacies. Due to a limited suspension system, the tires continually scuffed on the underside of the trailer bed during cross-country maneuvers. The frame of the trailer and yoke fractured and several tire rims were badly bent during the cross-country mobility testing. Other features that require improvement include a provision for larger brakes, brake actuator fitting boot caps, and a lengthened trailer tongue. As in the case of the 12½-ton logistics trailer, some type of container guide at each trailer corner is

recommended to facilitate the placement of containers precisely over the ANSI/ISO configured locking devices. These issues were reviewed with industry prior to issuing the RFP.

Quantity. The quantities of 22½-ton logistics trailers recommended for POM 83 have been determined by an analysis of the present assets allocated to a baseline MAF utilizing the mobilization troop list data as well as an analysis of the CVM recommendations. Consideration was also given to unit missions, tonnage requirements, and interaction of the vehicle with other components of the motor transport subsystem.

Generally, the 22½-ton logistics trailer will be the primary cargo-hauling vehicle. In addition, it will be utilized to haul a 15-cubic-yard horizontal dump module for large earth-moving tasks. An inventory objective of 750 has been obtained for planning purposes by determining the initial issue for each MAF, using the mobilization troop list data for actual T/E structure and location, plus other assets as shown:

FMF 60-Day Quantity		
• I MAF	168	
• II MAF	168	
• III MAF	168	
• IV MAF	168	
ORF	20	
General Support	11	
Mobilization Training	1	
Maintenance Float	10	
PWR	36	(90)*
Total	750	(804)*

Cost. The cost of the 22½-ton trailer is estimated by HQMC at $20,600 in terms of FY82 dollars.

Phase-In. The 22½-ton logistics trailer is scheduled for phase-in as shown below.

	FY84	FY85	FY86	FY87	FY88	Total
22½-ton logistics trailer	153	165	150	147	135	750

4.8 MOBILIZER/TRANSPORTER

Description. This vehicle is a recent addition to the FLS system. The 40-foot flatrack has generated a requirement for a vehicle capable of transporting this item. Currently, two systems are under consideration, one of which is a mobilizer system which would consist of a set of wheels that could be attached to the flatrack itself. The second alternative would be

*Post D-day 180-day requirement.

to procure sufficient quantities of the M872 semitrailers which are currently under U.S. Army procurement.

Replacement. This will be a new item of equipment.

Development Status. The U.S. Army has tested both the mobilizer and the 40-foot trailer. In order to initiate development of this item, a ROC, work directive, and a request for RDT&E funds must be made.

Quantity. The recommended quantity of these vehicles is as follows:

FMF 60-Day Quantity	
• I MAF	30
• II MAF	30
• III MAF	30
• IV MAF	30
General Support	1
Total	121

Cost. Cost of the M872 semitrailer has been estimated to be $16,300.

Phase-In. All 121 vehicles will be phased in during FY85.

4.9 SEMITRAILER (65-TON)

Description. This vehicle will be a 65-ton capacity low-bed semitrailer capable of transporting heavy equipment and tanks. The trailer will be capable of on-and-off-road operations and be able to transport disabled tanks in various environments. The prime mover for the 65-ton semitrailer will be the heavy prime mover, appropriately modified.

Replacement. This vehicle will replace the existing 65-ton semitrailer. In addition, the Marine Corps is monitoring the development of the Army's heavy equipment transporter (HET) system as a possible candidate to fill this requirement.

Development Status. Currently, there is no firm selection for the 65-ton semitrailer. Commercial models are being examined to find a suitable item.

Quantity. The recommended quantity of these vehicles is as follows:

FMF 60-Day Quantity	
• I MAF	4
• II MAF	4
• III MAF	4
• IV MAF	4
General Support	1
Total	17

Cost. Cost of the 65-ton semitrailer has been estimated to be $57,300. This is based on the cost of similar commercial vehicles.

Phase-In. All 17 vehicles are scheduled for phase-in during FY88.

SECTION 5

MATERIAL HANDLING EQUIPMENT (MHE) SUBSYSTEM

5.1 INTRODUCTION

The MHE subsystem of FLS is made up of the following elements:

- Rough-terrain forklift, 4,000-pound
- Rough-terrain forklift, 6,000-pound
- Rough-terrain forklift, 10,000-pound
- Rubber-tired, rough-terrain crane, 30-ton
- Container handler
- Lightweight amphibious container handler (LACH)

The MHE subsystem is critical to overall system effectiveness. It is the key link in stuffing and unstuffing of 8'x8'x20' containers, in loading and unloading of trailers, and in local movement of pallet and small/intermediate container loads. Its responsiveness must be ensured if the requisite flow of material is to be maintained in support of amphibious operations.

The MHE subsystem in large part is comprised of equipments that have been modified or adapted for their FLS roles. This has proven to be an expeditious, relatively low-cost approach to acquire the needed capabilities. However, from an equipment characteristics point of view, the MHE subsystem and task requirements, in certain instances, were not fully compatible initially. These incompatibilities resulted in two major modifications to the MHE subsystem during the past year.

The first compatibility variance concerns the Drott 30-ton crane. This crane was designed for use in the loading and unloading of landing craft and performance of construction and heavy-lift tasks ashore. It performs well for its designed use and was selected for FLS application because of its availability, load capacity, reach, and mobility. Test experience, however, has demonstrated that the crane cannot "walk" with a load of over 16,000 pounds, thereby appreciably limiting its ability to efficiently handle the large size 8'x8'x20' containers. These containers, when loaded, can have gross weights ranging from 15 to 22 tons, depending on the contents.

In view of the 30-ton crane's operational shortcomings, HQMC (Code LM-2) has introduced a new element, designated a container handler, into FLS during this past year. The

container handler is envisioned as a front loader capable of rapid and efficient handling of 20–40-foot ANSI/ISO standard containers (or container equivalents). It will be employed primarily in the container marshalling area but can also assist with general container-over-the-shore offloading operations.

A second incompatibility involved the use of a closed loop, highly sensitive air pallet system in an unimproved amphibious objective area.

As a result of data collected regarding feasibility of the air pallet system in an AOA environment, the decision was made by HQMC (Code LM–2) to discontinue efforts to acquire the system. Background information leading to this decision is contained in NSI Report V9340–79–L044, 22 January 1979, and letter D 075, Marine Corps Development and Education Command, 25 January 1980, subject: Air Bearing Technology for Container Stuffing and Unstuffing.

The three types of forklifts included in FLS are the Terex 10,000-pound, Pettibone 6,000-pound, and Case 4,000-pound rough-terrain forklifts. These three provide a full range of capability with one minor exception. The possibility exists that some eight-packs of PALCONs will exceed the 10,000-pound RTFL's capability. In these instances, the 30-ton crane would be required. Also, since modifications were required to both the 4,000-pound and 10,000-pound forklifts, the Material Handling Equipment, Forklift Study and Evaluation concludes that "the most economical mix of forklifts cannot be determined until the 4,000-pound forklift has been in service for a year." At this time, every indication is that the modified forklift equipment is performing successfully; however, adequate tracking and documentation is recommended to provide a solid base for an optimum second-generation procurement.

Overall development of the MHE subsystem of FLS is proceeding exceptionally well in terms of demonstrated compatibility and reasonable cost. The major operational problems were identified early on and have been or are being overcome through the joint efforts of HQMC, MCDEC, and CEL. Simulation studies were conducted to verify the optimum mix of MHE, and future operational testing will be used to demonstrate performance and establish the most efficient and responsive mix of equipment.

5.2 4,000-POUND FORKLIFT

Description. The Case 4,000-pound forklift has been modified to better perform the stuffing and unstuffing of 8'x8'x20' containers and the loading/unloading of trucks and trailers in the Combat Service Support Area/Beach Support Area (CSSA/BSA).

Replacement. This forklift will not replace any current equipment.

Development Status. During operation Solid Shield 75, at Camp Lejeune, North Carolina, the Shore Party Battalion, 2nd Marine Division, tested and evaluated the existing 4,000-pound forklift. It was also tested at Little Creek, Norfolk, Virginia, in June 1975. As a result of these tests, mast modifications were recommended to provide an increased lift height to 100 inches and a side-shift capability. The original lift height of 66 inches was found to be inadequate for stacking PALCONs more than two high. The lack of a side-shift capability made it impossible to stuff/unstuff the 8'x8'x20' container since the forklift could not get close enough to the inside container wall to properly align with the pallet tineways. Modified forklifts were put through developmental tests at MCDEC and Fort Belvoir during September 1978. Operational tests were completed during the first quarter of FY79 at Camp Lejeune, North Caroiina. As a result of these tests, a visibility problem was discovered due to the mast modification. In July of 1979, MCDEC monitored tests by the U.S. Army on a modified forklift manufactured by Case Corporation that was capable of performing the Marine Corps tasks. As a result of the Army tests, MCDEC has recommended purchase of the Army modification kits.

Test Schedule. Tests for a new modification kit have been completed.

Quantity. Modified forklifts will be required by all units involved in CSSA/BSA operations. Using the T/Es which are assigned 4,000-pound forklifts, a requirement for approximately 91 modified forklifts per MAF was established, for a total of 364. However, since this amount will not modify the entire inventory objective (IO), it is not considered logistically sound to simply convert part of the inventory. This would cause training and material management problems due to equipment dissimilarities and, in the end, would probably prove more costly than total inventory modification. Therefore, the entire inventory of 4,000-pound forklifts will be modified.

FMF 60-Day Quantity		
• I MAF	86	
• II MAF	78	
• III MAF	75	
• IV MAF	87	
ORF	36	
General Support	8	
Mobilization Training	2	
PWR	15	(40)*
Total	387	(412)*

Cost. The cost of each mast modification kit is $5,350. Installation can be performed in the field.

*Post D-day 180-day requirement.

Phase-In. Ninety-three modification kits are being purchased with FY80 funds. The remaining kits will be purchased in FY81. Once delivery of these kits is complete, MCLB Albany will issue a modification instruction to the field. This could take place as early as the end of first quarter, FY82. At that time, the units will be issued the modification kits and will perform a field modification.

5.3 6,000-POUND FORKLIFT

Description. The Pettibone 6,000-pound forklift will be used primarily for offloading pallets and PALCONs from beached landing craft and for loading these pallets and PALCONs onto trailers. The 6,000-pound forklift will also be employed to handle partially loaded QUADCONs.

Replacement. This forklift will not replace any current equipment.

Development Schedule. The Pettibone 6,000-pound forklift is a product-improved version of existing equipment. No Marine Corps development efforts are required.

Test Schedule. The final phase of first-article test and acceptance was completed during second quarter, FY80.

Quantity. The current 60-day IO for the 6,000-pound forklift is 534. The procurement contract, completed in FY79, called for 504 product-improved forklifts. An option to purchase 41 additional forklifts in FY80 has been exercised.

FMF 60-Day Quantity		
• I MAF	117	
• II MAF	115	
• III MAF	115	
• IV MAF	117	
ORF	31	
General Support	16	
Mobilization Training	2	
PWR	21	(100)*
Total	534	(613)*

Cost. The contract awarded to Pettibone in the second quarter of FY79 called for 504 forklifts at a total cost of $19.2 million, or $38,000 per forklift.

Phase-In. First article testing was successfully completed during the second quarter, FY80. Delivery of forklifts commenced during the third quarter, FY80. Pettibone plans to maintain a delivery rate of 50 units per month. The equipment is being sent directly to field units and delivery is expected to be completed during the second quarter, FY81.

*Post D-day 180-day requirement.

5.4 10,000-POUND FORKLIFT TRUCK

Description. The Terex 10,000-pound forklift truck has been modified to provide it with the capability to handle single QUADCON containers and arrays of PALCONs weighing up to 10,000 pounds.

Replacement. This forklift will not replace any current equipment.

Development Status. Development has been completed.

Test Schedule. Testing has been completed.

Development Problems. None.

Quantity. The contract calls for modifying the entire inventory of 367 forklifts, which is three more than the present 60-day IO.

FMF 60-Day Quantity		
• I MAF	75	
• II MAF	76	
• III MAF	75	
• IV MAF	76	
ORF	12	
General Support	20	
PWR	30	(72)*
Total	364	(406)*

Cost. Total costs for the upgrade program will be approximately $15 million or $40,800 per unit.

Phase-In. The Marine Corps had originally contracted with Terex to rebuild the forklift trucks at the rate of 10 per month. Initially, the PWR was rebuilt in order to provide turnaround assets for FMF units and thus prevent a decrease in the readiness posture. The reserve MAF assets will be upgraded last. During the second quarter, FY80, the production rate was increased to 20 per month.

Phase-in scheduling is being handled by the 10,000-pound rough-terrain forklift item manager at MCLB, Albany. Phase-in began in September 1979 and at the present production rate, field issue can be completed by the end of second quarter FY81.

5.5 30-TON CRANE

Description. The 30-ton rubber-tire rough-terrain crane is a diesel-driven hydraulic unit capable of lifting up to 30 tons with extended outriggers. On level ground, it can lift 28,300 pounds without outriggers and with minimum boom radius. The crane operator's cab will revolve 360^{0} and the telescopic boom is extendible to a length up to 73 feet. The crane

*Post D-day 180-day requirement.

is capable of a road speed of at least 20 miles per hour with a range of approximately 100 miles.

The crane's proposed FLS functions are to handle QUADCONs and PALCONs on the beach and in the surf during the assault phases; load and unload vehicles carrying PALCONs, QUADCONs, and 8'x8'x20' containers in the combat service support area; and provide engineer assistance for erecting shelters and other functions.

Replacement. The 30-ton crane replaces the crawler-mounted 16-ton crane and the truck-mounted 15-ton crane.

Development Status. A total of 192 cranes have been procured. Crane selection was based on demonstrated performance during tests carried out by the 8th Engineer Battalion at Camp Lejeune, North Carolina.

Test Schedule. Testing has been completed.

Development Problems. No problems exist regarding the capability of the 30-ton crane to perform its primary FLS functions, i.e., the handling of arrays of PALCONs and QUADCONs coming ashore during an amphibious operation, both on the beach and in the CSSA. It also has the capability, as a secondary function, to handle loaded 8'x8'x20' containers. However, as previously stated, its capability in this respect is limited.

Report number 41014-0-05-4, "Crane, 25-Ton, With Attachments," published by MCDEC, recommends that development of container-handling procedures and container-handling devices be continued. This could enhance the operating capability of the 30-ton crane in its backup role as an 8'x8'x20' container-handling equipment.

Quantity. Procurement of 192 cranes is complete and provides 3 cranes more than the present 180-day IO.

FMF 60-Day Quantity		
• I MAF	36	
• II MAF	36	
• III MAF	36	
• IV MAF	37	
ORF	13	
General Support	8	
Mobilization Training	1	
PWR	7	(22)*
Total	174	(189)*

Cost. Total contract cost was $29 million, or approximately $151,000 for each crane in terms of FY78 dollars.

*Post D-day 180-day requirement.

Phase-In. All cranes have been delivered and provisioning is complete. MCLB, Albany, is currently in the process of issuing this item to the field.

5.6 CONTAINER HANDLER

Description. The container handler is a self-propelled 50,000-pound capacity, commercially available frontloader capable of transporting, transferring, and/or stacking 20-, 35-, and 40-foot containers or container equivalents. The requirement for this equipment has been identified as a result of the limited capability of existing FLS equipment to efficiently transport, transfer, and/or stack the large number of containers that are expected to flow into the container marshalling area.

Replacement. This equipment is a new initiative.

Development Status. Since the container handler was added to the FLS in FY80, no development efforts have been started. (The Army contracted with Caterpiller Tractor Company in September 1978 for 175 rough-terrain container handlers.) The monitoring of Army field and performance evaluation has been identified as a task for MCDEC during FY81.

Test Schedule. Performance testing of commercial candidates is scheduled for first quarter, FY83.

Development Problems. The Army version of this piece of equipment is outside the width and height envelope of an 8½'x8'x40' commercial flatrack. This would necessitate on-deck loading on commercial shipping unless modification of size to conform to flatrack size is feasible.

Quantity. Inventory objective is 25.

FMF 60-Day Quantity	
• I MAF	6
• II MAF	6
• III MAF	6
• IV MAF	6
General Support	1
Total	25

Cost. The cost of a commercial 50,000-pound, rough-terrain container handler is estimated to be $225,700 in terms of FY82 dollars.

Phase-In. The projected contract award date is FY84. Present planning calls for provisioning and delivery to be completed by the third quarter, FY85. Since the container handler is a type 3 equipment category classification, the issue will be held in depot until conditions arise which require its use. As a type 3 equipment, only a training allowance would be authorized by HQMC for issue to the FMF and the Engineer School.

5.7 LACH

Description. The LACH is a straddle-lift, rough-terrain hoist used to transfer 8'x8'x20' containers from landing craft to trailers on the beach in the event that the elevated causeway is not operational. The LACH is also capable of loading and unloading trailers in CSSA/BSA operations.

Replacement. The LACH will not replace any current equipment.

Development Status. Development of the LACH is considered crucial to the realization of a full FLS capability. A prototype LACH was tested during the Logistics-Over-The-Shore (LOTS) exercise, conducted at Fort Story, Virginia, in August 1977. The LACH operated primarily on the beach and in 1- to 2-foot surf during the exercise and performed exceedingly well. Numerous iterations of transferring containers from landing craft to a beach storage point and from that point to logistics vehicles confirmed its utility. It provided the Marine Corps with an enhanced container-handling capability.

Some minor modifications to the LACH were recommended. These included changing the flange connections on the vertical legs, strengthening the pintle-lunette connection, and use of foam-filled tires. The LACH was subsequently modified and tested during Solid Shield 78. The vehicle operated on the beaches at Camp Lejeune, North Carolina, and in 3-foot surf. Again the LACH performed up to expectation. Similar testing and results occurred during Solid Shield 79, at Camp Lejeune.

Test Schedule. Testing is complete. Based on the field test results and the recommendation of the Commanding General, FMF, Atlantic, the LACH was approved for service use on 15 December 1978.

Development Problems. Development is complete.

Quantity. The proposed IO quantity of LACHs is presently 57. The primary mission of the LACH is to handle containers from beached landing craft and within the BSA/CSSA. In addition, it serves as an alternate means to the elevated causeway for container operations. Based on a simulation analysis of the FLS support capability, an average of 10 LACHs would be required per MAF to support the elevated causeway during container offloading operations. This container offloading operation simulated the maximum throughput rate which could be sustained by the combined use of three temporary container discharge facilities, two elevated causeways, and as many landing craft as required from an available mix of 24 LCUs, 92 LCM-8s, and 56 LCM-6s. Although this analysis simulated the maximum container-handling demand which could be expected, an average of 10 LACHs was required to maintain their constant use. It is highly unlikely that such a situation could be sustained. In order to provide backup equipment and allow for possible LACH operations in ammunition

storage points, 14 LACHs per MAF is considered a viable quantity from an operational point of view.

FMF 60-Day Quantity	
• I MAF	14
• II MAF	14
• III MAF	14
• IV MAF	14
Total	56

Cost. The FY81 LACH unit cost is estimated to be $101,800.

Phase-In. A projected contract award date is FY81. Present planning calls for provisioning and delivery to be completed by the third quarter FY82. Since the LACH is a type 3 equipment category, the issue will be held in depot until conditions arise which require its use. As a type 3 equipment, requisition, except for training allowance, would only be authorized by HQMC.

SECTION 6

SERVICE SUPPORT SUBSYSTEM

6.1 INTRODUCTION

This subsystem includes a variety of service support items of equipment required to support Marine Corps combat operations. They are categorized in the following broad functional equipment designations:

- Engineer
- Electric power support
- Bulk storage distribution
- Food service
- Medical
- Personal

Many of these items are being configured to take advantage of the efficiency, flexibility, and usefulness of standard ANSI/ISO containers and shelters. Development of some of these service support items in modules may permit their utilization aboard commercial ships in support of embarked forces, as well as for combat operations in the field. They are also being designed for interface compatibility with each of the other FLS subsystems, i.e., container, shelter, motor transport, and material handling equipment. Their development in modular form also permits the elimination of many dedicated vehicles and their attendant support requirements. Further, some of these systems are being developed to meet functional requirements for which no present equipment exists. In other instances, they significantly improve the quality of services delivered to Marines, while at the same time reducing manpower and overall support requirements.

Recommended equipment inventory quantities are based on a projection of Marine Corps needs as derived from current requirements examined in conjunction with recent directives, studies, and analyses. The inventory objective provides suggested quantities for each MAF, plus allowances for operational readiness float, maintenance float, special mission forces, general support forces, mobilization training, shipping losses, and prepositioned war reserves. The inventory objective indicates requirements for a post D-day consumption period of 60 days and 180 days. The phase-in and phase-out dates reflect the support equipment development status, current asset wear-out age, and funding considerations. The

description and a status evaluation of the 26 elements which comprise the service support subsystem follows.

6.2 BRIDGING, DRY GAP

Description. The medium girder bridge (MGB) is lightweight, easily transportable bridging equipment which can be erected by hand in various configurations to support a wide range of military bridging requirements. The MGB is designed for use by wheeled and tracked vehicles and will support up to class 60 loads. It is a two-girder bridge, with deck units fitted between the two longitudinal girders to provide a 13-foot-wide roadway. Beams connect the girders at each end and ramp units are attached to provide access. For maximum flexibility, the longitudinal girders can be assembled in single- or double-story construction.

The British-manufactured MGB consists of several basic components and, with the aid of an erection set, provides class 60 bridging for spans up to 100 feet. With components from a second MGB and a reinforcement set, the class 60 capability can be extended to a total span of 160 feet. All of the MGB components can be handled by four to six men. Additionally, the components can be packed in 8'x8'x20' ANSI/ISO configured containers. The maximum weight of any one component is 600 pounds. While the size and weights of MGB components are compatible with 8'x8'x20' shipping containers, this has yet to be operationally tested. Consequently, packaging arrangements, load sequencing, and container "dead space" may cause flatrack loading alternatives to be more advantageous.

Although designated as a class 60 bridge, the MGB has the potential of supporting heavier class loads. The manufacturer is conducting discrete tests to verify this. A single story wet gap MGB with pontoons has already supported class 100 loads during British Army tests in the summer of 1980. The manufacturer is developing a link reinforcing set which should support class 70 loads. The current estimated service life of 10,000 crossings has been exceeded without apparent damage, however, heavier (class 60+) loads could change this. U.S. Army Technical Manual 5-312 indicates that class 100 can be achieved using caution or risk crossings which involve reduced vehicle speed and greater intervals between vehicles. A capability of greater than class 60 is desirable in order to allow gap crossings by the XM-1 tank which will be rated at approximately class 62.

Replacement. The MGB replaces the class 60 fixed highway bridge, model M-6. The fixed highway bridge requires 21 M118A1 6-ton trailers to transport all the equipment included in the bridge set. The MGB, with its capability of being stored and transported in containers, is compatible with the FLS motor transport subsystem and eliminates the need for dedicated trailers. The MGB will also replace the fixed floating bridge, model M4T6.

Quantities, status, and development plans for this adaptation of the MGB are discussed under section 6.3 of this appendix.

Development Status. The MGB was designed and developed by the British Military Vehicles and Engineering Establishment (MVEE) and is manufactured by Fairey Engineering, Ltd. (FEL), of the United Kingdom. To date, it has been purchased by 27 countries and has been type classified and purchased by the U.S. Army. The Army has issued the MGB to several divisions.

A cable reinforcing set (CRS) was developed and type classified by the U.S. Army in FY78. FEL has developed a link reinforcement set (LRS) designed to provide the same capability as the cable reinforcement set. The Army and, at this point, the Marine Corps have opted for the CRS because the LRS had not been tested at the time of the Army procurement decision. The associated junction panels and ramp slopes with the CRS are also different from the British version.

FEL has tested a LRS. The tests indicate that it will provide a class 70 capability for spans up to 162 feet. Army units in Europe have utilized the LRS on a trial basis. The Army will commence tests during 1981. A final decision has not been made by the Marine Corps as to which set to adopt. This decision will depend on the outcome of the Army tests.

Test Schedule. The bridge has been approved for service use based on U.S. engineering considerations. However, the Marine Corps plans to evaluate packaging requirements and a floating mode for the MGB during FY81. Evaluation objectives will be toward optimizing transportability, flexibility of employment, and ease and speed of erection. Evaluation of the dual-purpose container/float design indicated under section 6.3 may have an impact on final packaging requirements for the MGB. When the bridge becomes available, operational and familiarization testing with FMF bridging personnel will be conducted.

Development Problems. The MGB is a proven capability that offers significant advances in operational flexibility, speed and ease of erection, and maintenance over the current fixed highway bridge. Determination of a link reinforcement versus a cable reinforcement should be a priority item in order to settle procurement requirements. Packaging considerations for shipment also need to be expedited.

Quantity. The recommended quantity of medium girder bridge sets to replace the fixed highway bridge for the Marine Corps is 37, with 17 cable reinforcement and 17 MGB erection sets. Four reinforcing sets per MAF will permit the erection of four class 60 bridges with lengths up to 162 feet. Four erection sets per MAF provide the capability for each platoon of the bridge company to erect at least one bridge. Proposed distribution is as follows:

	MGB	CRS	Erection Set
FMF 60-Day Quantity			
• I MAF	8	4	4
• II MAF	8	4	4
• III MAF	8	4	4
• IV MAF	8	4	4
PWR	4	-	-
General Support Forces	1	1	1
Total	37	17	17

Cost. The cost of the MGB, the erection set, and the reinforcing set is estimated as follows: medium girder bridge, $993,000; MGB erection set, $329,100; reinforcing set, $248,681.

Phase-In. The recommended phase-in for the procurement of 37 MGB sets is as follows:

	FY83	FY84	Total
MGB	19	18	37

6.3 BRIDGING, WET GAP

Description. The wet gap bridging equipment is currently envisioned to consist of support equipage required to convert the medium girder bridging equipment (dry gap) to a floating bridge. Candidate suspension devices include the pontoons from the M4T6 bridge, a modified ANSI/ISO container, or the piers which are integral to the British version of the MGB. The ANSI/ISO container could be converted to a pontoon by reassembling the containers in which the dry gap bridge equipment is packaged. The containers would be 4'x8'x20' with ANSI/ISO fittings for stacking and handling. They would be designed so that the top and sides can be lifted off as a single unit which, when inverted, provides a watertight float or pontoon. The bridge parts will be strapped to the base in the manner of a pallet. When the parts have been unloaded from the base, it will be replaced on the inverted container to form a deck with bridge connection points. Piers in the current British version of the MGB are designed to elevate the bridge 42 feet over a gap (wet or dry).

Replacement. The wet gap bridge equipment, when used with dry gap bridge components, will replace the current fixed, floating, 60-ton bridge.

Development Status. An engineering contract to produce and test a prototype of the 4'x8'x20' container/pontoon concept has been awarded. The prototype is scheduled for completion and delivery to the Marine Corps by 30 June 1981.

Test Schedule. Feasibility tests of the container/pontoon prototype will be conducted as part of the engineering contract mentioned above. Operational test schedules are to be determined.

Development Problems. None.

Quantity. Four MGB and three support systems per MAF would provide the capability to erect three wet gap bridges ranging in length from 162 to 320 feet. Proposed distribution is as follows:

	MGB	Support Supplement	CRS	Erection Set
FMF				
• I MAF	4	3	2	2
• II MAF	4	3	2	2
• III MAF	4	3	2	2
• IV MAF	4	3	2	2
General Support Forces	--	1	--	--
Total	16	13	8	8

Cost. To be determined.

Phase-In. In order to complete the transition from the current fixed and floating bridges to the MGB, the wet gap bridge should be procured during FY84 and phased in during FY85.

6.4 MARINE CORPS ENVIRONMENT CONTROLLED MEDICAL SYSTEM (MCEMS)

Description. MCEMS is a modularly constructed field medical facility designed for rapid employment under expeditionary conditions. Medical equipment and supplies peculiar to the medical and dental functions will be mounted and stored in standard Marine Corps shelters. The complex will consist of 8'x8'x20' rigid and 8'x8'x20' knockdown shelters with joining corridors. Maximum utilization of standard Marine Corps support equipment is planned for heating, cooling, electrical power, and water distribution. Functions to be modularized are surgical, laboratory, pharmacy, intensive care, sterile preparation, X-ray, emergency treatment, receiving, orthopedic, eye-ear-nose-and-throat (EENT), oral surgery, patient wards, and dental.

Replacement. The standard shelters will replace various tents presently used to house medical and dental functions. The shelter square-footage requirement will approximate the square footage of displaced tentage.

Development Status. Portions of five medical functions (surgical, lab, pharmacy, ICU, sterile preparation) have been installed in 5 rigid 8'x8'x20' shelters and 12 knockdown shelters of the same size for operational testing. Total shelter requirements to house these five functions are as follows:

Function	8'x8'x20' Rigid	8'x8'x20' Knockdown	Total	Cumulative Total
Surgery	16	16	32	32
Intensive	7	63	70	102
Lab/pharmacy	14	7	21	123
Sterile preparation*	8	8	16	139

*It may be necessary to use all rigid shelters to ensure that individual shelter weight does not exceed 10,000 pounds.

MCEMS components will be assigned to the hospital company of the medical battalion or the dental company, as appropriate. The equipment being installed in the shelters consists primarily of medical items contained in authorized medical allowance lists, selected items from the Army's Medical Unit, Self-Contained Transportable (MUST) program, and also new items.

The present plan is to add the other functions to the system as the respective pertinent R&D is completed. It is anticipated that X-ray, emergency treatment, receiving, orthopedic, and EENT units will be configured in shelters for testing in FY81. A contract for 11 rigid 8'x8'x20' and 19 knockdown 8'x8'x20' MCESS shelters for the development of additional functions was awarded during FY79 and amended in FY80. The remaining functions of oral surgery, dental operatory, medical supply, and administration will be configured in shelters in FY81 and during the first half of FY82.

Test Schedule. Seventeen shelters configured to support a portion of MCEMS were tested as part of mass casualty evacuation exercise by the 2nd Medical Bn at Camp Lejeune during April–May 1980. MCEMS functions employed were surgery, intensive care, lab/pharmacy, supply, and a patient ward. OT–II will be conducted at Camp Lejeune during the second and third quarters FY81. MCEMS will continue to be employed in exercises. The initial results of the Camp Lejeune tests indicate that there are no problems related to the medical functions of MCEMS.

Development Problems. Currently, no development problems are known to exist with MCEMS.

Quantity. As currently envisioned, a total of 139 shelters is required for the first five medical functions undergoing OT-II. It is estimated that approximately 138 additional shelters will be required to house the remaining functions. One MCEMS is required by each MAF, resulting in an IO of four MCEMS for the Marine Corps.

Cost. The cost of a MCEMS complex for the first five functions (surgery, ICU, laboratory, pharmacy, sterile preparation) is estimated to be $3.7 million in terms of FY82 dollars.

Phase-In. Two of the four complexes are expected to be procured during FY83 and one each during FY84 and FY85. As R&D is completed on the other functions, they will be phased in at the rate of two or three new functions each year. Tents will be phased out as the shelters become available. Phase-in will follow procurement by 1 year.

6.5 FUEL/WATER STORAGE MODULE

Description. The fuel/water storage module is a rigid 1,000-gallon storage tank with associated hardware mounted in a 4'x6-2/3'x8' metal shipping frame. The frames (SIXCONs) have ANSI/ISO fittings to enable use of connectors which permit six frames to be locked together to form an 8'x8'x20' configuration. The pump module is mounted in an identical shipping frame and can be included in the multiple configuration to provide a pumping capability. The fuel/water storage module has a tare weight of approximately 2,500 pounds and is compatible with the pump module hardware. The same storage module is also used to store the chemicals employed by the advanced multipurpose surfacing system (AMSS). Assuming a storage module tare weight of 2,500 pounds and a usable capacity of 950 gallons, five fully loaded fuel storage modules plus one pump module will weigh approximately 47,000 pounds when arrayed in an 8'x8'x20' configuration. A similar array containing six water storage modules will weigh in excess of 62,000 pounds. In both cases the weight exceeds the nominal on-road load rating of the 22½-ton trailer. Consequently, when transporting 6-arrays of fuel/water modules by trailer, it will be necessary to reduce the module fill level to a maximum gross weight of 45,000 pounds. Another method to reduce the weight placed on a trailer is to employ the modules in a "half high." Three frames are connected together forming a 4'x8'x20' configuration. This becomes the basic configuration for trailer loads. In order to meet ANSI/ISO standards for internal loads in commercial aircraft the load must be able to "breakover" when it reaches the top of the aircraft loading ramp. A SIXCON or a half-high configuration will not do this. Therefore, the modules must be loaded as individual 4'x6-2/3'x8' frames. They can be connected with ANSI/ISO fittings aboard the aircraft or after unloading.

Units having high fuel consumption rates that require a pumping capability will be furnished fuel pump modules. Units not equipped with a pump module or having a limited number of pump modules will be furnished heavy-duty portable jackstands in order to elevate the modules up to 60 inches off the ground to allow a gravity feed to fuel/water receiving equipment and containers. This will also permit loading and unloading of modules from trailers without the need for forklift support.

Replacement. The fuel/water storage module, in conjunction with the pump module, will replace all existing fuel and water tanks and trailers.

Development Status. The fuel/water module prototype was originally constructed with a collapsible rubber tank. That tank has since been converted to a rigid metal tank in order to eliminate leakage problems and improve the limited shelf life associated with a fabric tank. A second-generation rigid tank prototype was delivered to MCDEC during late FY78 for development and operational testing during FY79. DT-I and OT-I have been completed except for cold weather environmental tests which are in progress. Some minor engineering changes are planned, including addition of an adapter for the D1 nozzle. These changes were incorporated into the procurement data package and a preproduction prototype contracted for and fabricated in FY80. MCDEC has also developed an accessory module for use with the storage module. It consists of an empty module with a nylon restraining system that will be used for the storage and movement of nozzles, nozzle stands, and miscellaneous hoses and spare parts for special-purpose fueling operations, including helicopters and VSTOL aircraft.

Health and safety criteria have been established by the Navy's Bureau of Medicine and Surgery, Environmental Health Section, relative to the storage and dispensing of potable water. The Bureau is expected to review maintenance and operation manuals to ensure that water tank cleaning procedures are adequate.

Technical requirements for a SIXCON jackstand were established and a contract was awarded for one set of four jackstands. Delivery of the jackstand set have been accomplished. The acceptance test is underway at MCDEC. The jackstand is not carried as an FLS item at this time; however, it is recommended that its development be monitored so that quantity requirements and procurement costs be identified and programmed. DT/OT I testing of the jackstand will be conducted at MCDEC during the first and second quarters of FY81.

Test Schedule. DT-II and OT-II are planned for FY81 utilizing preproduction prototypes of the fuel and water storage modules in conjunction with the fuel pump module. Testing will be completed by the fourth quarter of FY81.

Development Problems. Concern was expressed that the fuel and water storage modules would be incorrectly identified by users with the resultant mixing of fuel and water, or

use of fuel tanks to carry water and vice versa. This problem was resolved by the use of 1½-inch fittings and hoses for water tanks and 2-inch fittings and hoses for fuel tanks. Design problems for the module have been resolved. Retesting has been accomplished in time to meet OT-II test schedules with a preproduction model. A contract has been awarded by CEL to Gard, Inc., to design and fabricate an elliptical-shaped tank which will meet ANSI/ISO specifications and fit in the 4'x6-2/3'x8' frame. The contract is scheduled for completion by the end of March 1981. The contractor and the DPO will meet with Department of Transportation officials during the first quarter of FY81 to discuss DOT regulations which impact on the container.

No other development problems are foreseen that would adversely impact production and procurement.

Quantity. The IO for fuel/water module is 3,089. This number has been obtained on the basis of T/E allowances for the current family of fuel and water trucks and trailers. Basically, a gallon-for-gallon conversion was used to determine module requirements with two exceptions. First, the 400-gallon water trailer was replaced on a one-for-one basis by the 1,000-gallon water module in order to retain the tactical support flexibility represented by current assets. Second, the 1,200-gallon fuel truck was also replaced on a one-for-one basis by the 1,000-gallon fuel module. This reduction in total fuel tank capacity is permitted because fuel modules are being concentrated in motor transport units, thereby permitting a more efficient utilization of assets. These quantities may be increased if the elliptical-shaped tank, currently being designed, results in a lesser capacity than the 1,000-gallon tank. The allocation of these modules is as follows:

FMF 60-Day Quantity		
• I MAF	675	
• II MAF	652	
• III MAF	607	
• IV MAF	657	
ORF	131	
Maint. Float	155	
General Support Forces	82	
PWR	130	(263)*
Total	3,089	(3,222)*

Cost. The cost of the fuel/water module is estimated to be $7,600.

Phase-In. The phase-in schedule for the fuel/water module is shown below:

*Post D-day 180-day requirement.

	FY85	FY86	FY87	FY88	FY89	FY90	FY91	After FY91	Total
Fuel/water module	326	326	156	158	156	156	156	1,655	3,089

6.6 FUEL PUMP MODULE

Description. The fuel pump module consists of a pump which will be driven by a diesel engine, a filtration system, transfer system, and dispensing hardware, all mounted in a basic shipping frame which has ANSI/ISO fittings. The pump is utilized with the fuel storage module where a pumping capability is required. It weighs approximately 3,000 pounds and has a liquid transfer rate of 100 gpm. Hoses and fittings are provided so that a number of modules (maximum of five) can be simultaneously connected to the pump section for rapid discharge. Five fuel storage modules and one pump module can be joined together to form a standard 8'x8'x20' configuration.

Replacement. The pump module, in conjunction with the fuel storage module, will replace all existing fuel trucks and trailers.

Development Status. The existing pump is operational but it employs a gasoline engine. Plans call for the pump to be driven by a diesel engine. The Army is working on a product-improved diesel engine for the pump. This pump has been tested satisfactorily by the Army at temperatures of -5^{0} C to -25^{0} C. Other Army projects include development of a 300-gpm pump in order to satisfy aircraft refueling requirements and a study of an arctic fuel dispensing system. MERADCOM has completed the documentation for the specifications of the pump and has forwarded it to MCLB Albany for review and comment.

Test Schedule. DT-II and OT-II are planned for FY81 utilizing preproduction prototypes of the fuel pump module in conjunction with the fuel/water storage module. Testing will be completed in July 1981.

Developmental Problems. No problems are anticipated in the fuel pump module development that would adversely impact planned production and procurement dates.

Quantity. The IO for the fuel pump module is 356. This has been based on the allowances for the current family of fuel trucks and trailers and with the planned distribution and employment of fuel storage modules. Additionally, pump modules have been allocated to units on the basis of anticipated need to transfer fuel from one module to another or to refuel aircraft, engineer equipment, tanks, amphibian tractors, or motor transport vehicles. The allocation of these modules is as follows:

FMF 60-Day Quantity		
• I MAF	80	
• II MAF	77	
• III MAF	70	
• IV MAF	78	
ORF	20	
Maint. Float	8	
General Support Forces	2	
PWR	21	(28)*
Total	356	(363)*

Cost. The cost of the fuel pump module is estimated to be $7,500.

Phase-In. Procurement of the fuel pump module is phased to coincide with the acquisition of the fuel/water storage module. The phase-in schedule is listed below.

	FY85	FY86	After FY90	Total
Pump module	53	46	257	356

6.7 WATER PURIFICATION SYSTEM

Description. The water purification unit is a 600-gph reverse osmosis unit capable of providing potable water from saltwater, brackish water, and impure freshwater sources. The unit will be mounted in an 8'x8'x10' ANSI/ISO shipping frame. Each unit includes a supply pump to provide raw water from a source to the settling tank, a feed pump, high-pressure filter inlet pump, storage tank pump, two chemical treatment pumps, and the associated controls for this equipment. Without the shipping frame, the unit's weight is 7,300 pounds. The unit requires 208-volt, 60-Hz power which must be supplied from an external source.

Replacement. The water purification unit will replace the erdalators and distillers listed below.

TAMCN*	Nomenclature
B2605	Water purification, erdalator, 1,500-gph, truck-mounted
B2620	Water purification, erdalator, 600-gph, trailer-mounted
B2625	Water purification, erdalator, 1,500-gph, frame-mounted
U3080	Distillation unit, 200-gph, trailer-mounted

*Table of Authorized Materials Control Number

*Post D-day 180-day requirement.

Development Status. The Army has prime responsibility for development of reverse-osmosis units. The 600-gph unit successfully completed development testing and was type classified by the Army during the third quarter of FY79. First article testing will be conducted in early FY81. MERADCOM currently has a larger reverse osmosis unit (2,000-gph) in engineering design and anticipates completion of its development process in FY82. The Marine Corps is monitoring this project.

Test Schedule. The Marine Corps conducted additional operational testing of the prototype unit at Camp Lejeune, North Carolina, to validate its saltwater purification capabilities and to determine required expendables. This testing was completed in August 1979 with the unit having generally exceeded it design criteria. No further testing is required.

Development Problems. Development is complete; however, it has been noted that heavy surf will cause the prefiltering component to clog with sand. MCDEC is studying this deficiency and, in time, a product improvement change is likely.

Quantity. Based on a gallon-for-gallon capability, substitution of the 600-gpm reverse osmosis unit for the T/E allowances of current water purification units indicates a requirement for 115 of the new units for each MAF. The 200-gph distillation unit was not included in this calculation as the reverse osmosis unit can purify saltwater as well as impure fresh and brackish water. One hundred fifteen units will produce approximately 20.7 gallons per man per day. Assuming a 16-hour-per-day operating period and a requirement of 20 gallons per man per day, a total inventory objective of 631 units is required with distribution as follows:

FMF 60-Day Quantity	
• I MAF	115
• II MAF	115
• III MAF	115
• IV MAF	115
ORF	40
Maint. Float	2
General Support Forces	2
Mobilization Training	2
PWR	125
Total	631

In the event the 2,000-gph unit being developed by the Army is approved for service use, a comparative analysis should be conducted to determine if Marine Corps requirements can most efficiently and economically be satisfied with a mix of 600-gph and 2,000-gph units.

Cost. Procurement cost of the 600-gph water purification unit is $157,300. Initial cost estimates for the 2,000-gph unit are not yet available.

Phase-in. The phase-in schedule of the water purification unit is shown below:

	FY82	FY83	FY84	FY85	FY86	FY87	FY88	Total
Water Purification Unit	38	127	96	118	118	118	16	631

6.8 SOIL STABILIZATION MODULE (AMSS)

Description. The advanced multipurpose surfacing system (AMSS) is designed to provide dust control, wind and water erosion control, and to place load distributing capacity over in situ soils. It can be used to surface roadways, parking areas, storage sites, helicopter and vertical/short takeoff and landing (VSTOL) pads and operating sites, etc. The system consists of a resin, catalyst, and promoter mixed and sprayed onto fiberglass matting, forming a $\frac{1}{4}$-inch-thick firm surface. Where additional strength and durability are required, a double layer is applied. The AMSS can be modularized into an 8'x8'x20' configuration consisting of SIXCON modules. The unit includes a pump module containing a control panel and proportioning pumps to mix the chemicals; an auxiliary module holding the catalyst, promoter tanks, cleaning solvent drum rack, and tool/accessory cabinet; two modules containing fiberglass rolls; and two fuel/water storage modules for the resin. Each AMSS unit has the capability to apply 14,400 square feet of surface, without resupply, at a rate of approximately 4,000 square feet per hour.

Replacement. AMSS was not developed as a replacement for Mo-Mat; however, it will probably replace some of the currently authorized Mo-Mat assault trackway kits.

Development Status. By the end of 1975, the AMSS program had been sufficiently developed to permit its procurement for general use; however, its chemicals exhibited a relatively short shelf life and reduced capability under wet climatic conditions. Since that time, new chemical formulations with a 5-year shelf life were prepared and successfully tested and the resin was modified so that it can be used under wet conditions. However, one of the AMSS chemicals, Vanadium Ten Cem, was withdrawn from the market by the manufacturer in 1978. An alternate commercial supply could not be located; consequently, the Naval Weapons Center, China Lake, California, was contracted to synthesize it. The task was completed during the first quarter of FY80. Since then, a substitute has been formulated and produced at NSWC, Indian Head, Maryland, and is considered feasible for commercial production.

Test Schedule. Remaining AMSS testing consists primarily of ANSI/ISO configuration testing for the modules. Testing of the synthesized Vanadium Ten Cem to verify the process

and the chemical's performance will be conducted during the fourth quarter of FY80, probably at MCDEC.

Development Problems. Efforts to modify the resin so that it can be used in cold (less than 25° F) environments were scheduled but deferred to permit development of the replacement for Vanadium Ten Cem. Consequently, it is unknown at this time whether a cold-weather capability can be successfully developed. In view of global Marine Corps operating requirements, it is considered that development of a cold-weather capability should be pursued at the earliest practicable date. The Bureau of Medicine and Surgery has directed that a study be conducted to determine the toxicity of the AMSS chemicals and their potential hazards to personnel. A report is expected from the Environmental Health Center, Norfolk, Virginia, during the second quarter of FY81.

Quantity. The recommended IO for AMSS units is 33. Distribution of the units is as follows:

FMF 60-Day Quantity	
• I MAF	8
• II MAF	8
• III MAF	8
• IV MAF	8
General Support Forces	1
Total	33

This quantity of AMSS units is based on the need to surface approximately 3.5 million square feet of roadway, storage area, helicopter, and VSTOL areas. This requirement is broken down as follows.

Helicopter landing zones (HLZs) (3)	298,614 square feet
VSTOL pads (4)	45,000 square feet
Main service roads (MSRs) (6 miles)	1,964,160 square feet
LSA (containers only)	1,254,988 square feet
Total	3,562,762 square feet

(This total represents an increase of approximately 400,000 square feet of surface over previous estimates due to a revised projection of the amount of material which will be placed in ditches and subsequently backfilled to anchor the material to the ground).

The VSTOL pad, MSR, and CSSA totals include a double layer of the AMSS surfacing. The HLZs require only a single layer. The adequacy of these allocations will be verified in operational tests.

The quantities for AMSS units that are recommended will provide only for surfacing high priority areas. The scenario for system utilization envisions a maximum of eight units from D+9 to D+14 to complete the priority surfacing by D+18. After this surfacing is

completed, the assets can be directed to assist in completing the remaining requirements of the earthwork construction phase. Other areas to be treated include the remaining MSRs, ammunition supply points, portions of the expeditionary airfields, and other designated hard-stand areas.

The requirements for the priority areas are as follows:

- HLZs. Two HLZs to support the buildup of the units that are airlifted to the assault area. A third landing zone is needed for the BSA. Each of the zones will require a 350-foot-diameter pad (or equivalent area) to support six to nine helicopter landing sites.
- VSTOL Pads. Four 72x72-foot pads to support AV-8A operations in support of a MAF assault.
- MSRs/BSA. Approximately 6 miles of roadway to support troop and equipment movement from the BSA to the CSSA and other high traffic MAF areas.
- CSSA. Approximately 14 acres of an CSSA must be surfaced to provide a hard surface for the container-handling and storage equipment.
- All requirements include an additional 6 feet of width to allow for surfacing to be placed in ditches and covered with earth to hold it down.

AMSS chemicals and fiberglass matting that are required to surface the areas discussed above will require 100-200 20-foot container equivalents per MAF for transport to the objective area.

Cost. The cost of the AMSS unit (not including chemicals and fiberglass matting) is estimated to be $77,000.

Phase-In. AMSS will be procured in approximately equal quantities in FY84 and FY85. Since AMSS has a type 3 equipment category classification, the item will be held in depot storage until conditions arise which require its use. As a type 3 item, requisitioning would only be authorized by HQMC, with the exception of training allowances. Additionally, operator safety instructions and environmental impact statements will be required prior to application exercises.

6.9 FIREFIGHTING EQUIPMENT

Description. The firefighting equipment will be housed in a SIXCON (4'x6-2/3'x8') and will be capable of dispensing water, foam, and other fire extinguishing chemicals. In addition to water and chemical storage tanks, the module will contain the necessary pumps, nozzles, hose, and reels. The unit will be operated manually and transported on logistics trailers.

Replacement. The firefighting unit will supplement and replace some quantities of the ¼-ton firefighting truck (MC 1051) and will be a new capability for the following units:

- T/E 3247, H&S Co., Maintenance Bn., FSSG
- T/E 8714, Engineer Squadron, MWSG

- T/E 8715, Motor Transport Squadron, MWSG
- T/E 8813, Headquarters and Maintenance Squadron, MAG (VF/VA)
- T/E 8914/8915/8916, Headquarters and Maintenance Squadron, MAG (VH)

Development Status. In the mid-1970s, CEL performed exploratory development of a module designed primarily for fighting POL fires. One version housed a commercially available remote-controlled "Fire Cat" vehicle and its supporting equipment in a SIXCON frame. Testing of the Fire Cat indicated that it was not sufficiently rugged and had some control deficiencies. Further, the supplier of this item has since gone out of business. A manual version was also obtained but was not tested to a significant extent. It is still available at CEL. A canvass of the firefighting equipment industry in 1978 revealed no active pursuit of remote-controlled firefighting equipment similar to the Fire Cat. CEL is conducting a state-of-the-art study of fire protection, firefighting techniques, and firefighting equipment relative to POL transfer and storage in an AOA and the potential for their use in other areas as well. Methods used commercially and by other services are being investigated and assessed for potential use by the Marine Corps. The study report is now anticipated in FY81. However, current R&D efforts are not targeted on remote-type equipment nor are they anticipated toward that goal in the foreseeable future.

Test Schedule. There is no testing scheduled. Such effort will depend upon procurement or development of suitable equipment and techniques resulting from the study efforts mentioned above coupled with the fuel and water module programs.

Development Problems. The state of the art for remote-controlled firefighting equipment such as the Fire Cat has not progressed sufficiently to obtain early resolution of the engineering problems cited above.

Quantity. The planned utilization of this equipment (manually controlled) and its applicability to fire control in areas other than POL storage facilities have not been developed to the degree where precise quantitative requirements can be made. However, for initial planning purposes, an IO of 163 has been established, distributed as indicated below.

FMF 60-Day Quantity	
• I MAF	36
• II MAF	36
• III MAF	36
• IV MAF	38
ORF	8
Maint. Float	4
General Support Forces	2
PWR	3
Total	163

Cost. Based on escalation of a 1979 industry estimate, the cost of the firefighting module is $32,000 in terms of FY82 dollars. This estimate will require revision when candidates are selected and development commences.

Phase-In. The firefighting equipment will be phased in through approximately equal increments in FY88 and FY89.

6.10 SANITATION UNIT

Description. The sanitation unit is a field head facility that is self-contained, self-operating, and modular in construction. It is designed to be compatible for use in bunkers, shelters, or containers and can be stored/shipped in pallet-sized loads. It will be used to provide a zero-effluent facility to be deployed in the field for combat and training, and aboard merchant shipping for embarked troops. Each unit consists of 2 urinals, 2 commodes, and associated treatment equipment and will serve approximately 50 men per day. The effluent treatment equipment consists primarily of a holding tank, incineration chamber, and necessary pumps and connecting lines. Two units can be installed in one 20-foot shelter.

A macerator previously intended for use has been removed from the system since it has been determined to be unnecessary as normal pressure causes the waste to break up. The macerator had caused the screen to become coated with waste, thereby preventing liquid from passing through the screen. Additionally, the electronic flushing system has been replaced by a mechanical system which is both more reliable and consumes less power. Each unit currently requires an external power source of approximately 10 kW (continuous). Efforts are continuing the reduce power requirements by utilizing exhaust emissions in the evaporators. Maintenance requirements are minimal. Treatment chemicals must be replaced monthly, and the operating fluid must be replaced periodically.

The system generates a continuous exhaust gas and a residual ash that must be removed monthly. Aboard ship the exhaust will have to be vented into the ship's exhaust system or to a weather deck. Ash is removed manually and does not constitute a disposal problem.

Replacement. This is a new capability.

Development Status. CEL completed exploratory development in September 1978 by successfully testing a laboratory model of the effluent treatment system. A developmental model was assembled and shipped to MCDEC for testing during the third quarter of FY79. Developmental testing was successfully completed in September 1979 and the unit was returned to CEL during the following month. Thereafter, CEL laboratory tested new concepts, such as an electrolysis cell to produce flush quality water for the unit during the early

part of FY80. CEL designed and fabricated a palletized version (second prototype) of the sanitation unit. It was laboratory tested during the fall of 1980.

Test Schedule. Testing is scheduled to be initiated at Camp Pendleton or Twenty-nine Palms, California, during the first quarter of FY81.

Development Problems. There are no major development problems with the sanitation unit.

Quantity. A total of 1,866 sanitation units are recommended for procurement. The units would be distributed as follows:

FMF 60-Day Quantity		
• I MAF	405	
• II MAF	405	
• III MAF	405	
• IV MAF	405	
ORF	80	
Maint. Float	16	
General Support Forces	5	
PWR	145	(327)*
Total	1,866	(2,048)*

The quantity of sanitation units is based on the need for zero-effluent facilities aboard merchant shipping to support personnel in the Assault Follow-On Echelon (AFOE). These same sanitation units will support the MAF Headquarters, FSSG, and MAW personnel in the objective area at a 25-percent level, which is considered adequate. The remaining 75 percent, plus the entire division, does not require zero-effluent support and can utilize alternative and field expedient means. Each sanitation unit can support 50 personnel.

Cost. The production cost of the sanitation unit is estimated to be approximately $6,300. This cost reflects escalation of the FY80 estimated cost. Mechanical and electronic refinements mentioned above may ultimately reduce the cost.

Phase-In. The phase-in schedule of the sanitation unit is shown below.

	FY85	FY86	Total
Sanitation unit	933	933	1,866

*Post D-day 180-day requirement.

6.11 COMBINED LAUNDRY AND BATH UNIT (CLABU)

Description. The laundry and bath unit is a combination shower and laundry housed in two ANSI/ISO 8'x8'x20' shelters. The laundry section utilizes a conveyor which processes clothing through a quick-agitation washing cycle and rinsing tank. The clothes then pass through the dryer element. The laundry section is designed to wash and dry an individual's clothing during the time that he showers in an adjacent bath/shower section. Personnel place clothing on the washer-dryer conveyor, then shower, dry, dress, and exit at the opposite end of the unit. The shower section will have six or eight shower heads. The laundry section is being designed to reclaim the used water and recycle it with minimal makeup. Recycling, similarly, will be available to the shower module when it is collocated with the laundry section. Since they are housed in separate shelters, both units can be employed independently. External power must be supplied to operate the unit.

The laundry and bath unit is not intended to satisfy all MAF laundry and shower requirements. Rather, its primary use will be in forward areas to periodically enable combat forces to take a quick shower and obtain a clean set of clothes and to provide a shower and clothes wash/dry capability for support of AFOE personnel embarked on containerships. It will not replace the need for separate shower and laundry facilities for remaining MAF personnel.

Replacement. The CLABU will partially replace the existing laundry unit and bath unit.

Development Status. A prototype laundry section built under a civilian contract is scheduled for delivery to CEL during December 1980. It will be installed in an 8'x8'x20' shelter and testing will commence. CEL is currently developing, in-house, a self-contained shower unit which can be inserted into a 8'x8'x20' shelter. Each modular unit is 6'x3'7", thus, three or four units can be inserted into one shelter. A module contains two flow-restricted shower heads. An in-line electric water heater will be installed in the water line in a location which would heat all of the water entering the shelter. Each module is built on a fiberglass deck. These decks rest above the shelter deck which allows for drainage from the module through a pipe leading out of the shelter. Duckboards and shelter modifications are not required. CEL is also currently testing alternative measures for recycling water. These methods include air filtration, the use of a carbon absorption column, and at least five different types of filter cartridges.

Test Schedule. DT-I on the entire laundry module will begin during the second quarter, FY81.

Development Problems. There are no known development problems. The shower unit can be operated independently of the laundry. It does not require dedicated shelters. The

Marine Corps should monitor its development in conjunction with the bath/shower unit in order to determine if two different shower units are required for the FMF.

Quantity. An IO of 58 laundry and bath units is recommended based on a need to support only division units and ground combat units that normally provide direct support to the division. The number of units recommended is also based on providing these personnel a shower every 3 days. The requirement also considers transportation and setup time and takes into account the dispersion of division units in a combat environment. The 58 laundry and bath units are distributed as follows.

FMF 60-Day Quantity		
• I MAF	12	
• II MAF	12	
• III MAF	12	
• IV MAF	12	
ORF	4	
General Support Forces	1	
PWR	5	(9)*
Total	58	(62)*

Cost. The original estimated cost of the CLABU was $136,000. Until the prototype can be examined and the new shower section developed, it is impossible to revise the cost estimate.

Phase-In. The phase-in schedule of these units is shown below.

	FY85	FY86	Total
Combined laundry and bath unit	27	31	58

6.12 DUMP MODULE

Description. The dump module will be of the ram-ejection type and will discharge its load via a hydraulically powered piston-type blade that pushes the load horizontally from one end of the module to the other. The module will consist of the ejector panel (blade), cylinders, hoses, and a control unit. The dump module will have a load capacity of 20 tons and will be configured to mount on and be transported by the 22½-ton logistics trailer. The hydraulics from the trailer's prime mover will power the unit.

Replacement. The dump module replaces a portion of the existing 5-ton dump trucks.

*Post D-day 180-day requirement.

Development Status. Development has not, as yet, begun on the dump module. However, commercial-type dump modules are currently available. During FY80, industry was monitored to determine the availability and suitability of existing items for Marine Corps use. Golay and Company, Inc., of Cambridge City, Indiana, was contacted regarding "RAM-E-JEC" dump modules. As the result of these inquiries, it was determined that the medium dump module originally slated to replace the 5-ton dump truck was not within the current industrial, technological state of the art. Consequently, the medium dump module was eliminated as a FLS element. However, Golay indicated that the dump module configured to be transported on the 22½-ton logistical trailer was a viable solution for replacing the 5-ton dump truck. Procurement of initial test items is planned in FY81. This element has been transferred to the cognizance of the engineer development project officer.

Test Schedule. Developmental testing is scheduled to begin during the fourth quarter of FY82.

Development Problems. No development problems have been identified at this time.

Quantity. The quantity of dump modules recommended for procurement is based on two factors. First, existing dump trucks will be retained in the combat engineer and landing support battalions. An analysis of earthmoving missions in the battalion reveals that these tasks are highly variable in nature and relatively small in size when supporting division units in forward areas. Generally, the combat engineer battalion does not engage in deliberate construction and earthmoving tasks. The engineer support battalion in the FSSG and the wing engineer squadron, on the other hand, normally operate in areas such as the BSA, EAF, and CSSA. Therefore, these units normally construct and maintain larger and more complex facilities that require economical earth-hauling equipment. Consequently, the 5-ton dump trucks in these units may be replaced by the dump modules provided configuration and testing are successful.

The second factor involves replacing existing capability on an approximate ton-for-ton basis. With the dump module's greater capability, one of these modules would replace four of the present 5-ton dump trucks authorized for the engineer support battalion and the wing engineer squadron.

An IO of 117 medium dump modules is recommended as follows:

FMF 60-Day Quantity	
• I MAF	24
• II MAF	24
• III MAF	24
• IV MAF	27
ORF	8
Maint. Float	9
General Support Forces	1
Total	117

Cost. The cost of the dump module is estimated at $12,200. These cost estimates were obtained from Golay and Company, Inc., and represents FY82 dollars for a production quantity buy.

Phase-In. The phase-in schedule for the dump module is shown below.

	FY87	FY88	Total
Dump module	59	58	117

6.13 REFRIGERATION SYSTEM

Description. The refrigeration system is a combination freeze and chill box consisting of a rigid, unitized, insulated box and a separate refrigeration unit. The size of the combined configuration is 8'x8'x10' and the unit is compatible with ANSI/ISO containerization standards. Two of the 8'x8'x10' units can be locked together to form an 8'x8'x20' container that also meets ANSI/ISO standards. This will, however, reduce the efficiency of the condenser and eliminate the freeze capability. Each box contains approximately 350 cubic feet of usable storage space. The unit operates on 200-volt, 60-Hz power. Power consumption will not exceed 5 kW. The weight of a complete system will not exceed 4,000 pounds. In the event of power interruption or refrigeration unit failure, the insulated box will be capable of maintaining the freeze or chill mode for a period of 24 hours.

Replacement. The new refrigeration system will replace the refrigeration units and boxes listed below.

TAMCN	Nomenclature
B1650	Refrigeration unit, 100-cubic-feet
B1660	Refrigeration unit, 630-cubic-feet
B1690	Refrigerator, prefab, 100-cubic-feet
B1700	Refrigerator, prefab, 630-cubic-feet

Development Status. The Natick Army Laboratories, Natick, Massachusetts (NLAB), has primary responsibility for developing the refrigeration system for the Marine Corps. Funding to support the development has been provided from DOD food service funds. Developmental and operational testing of prototype units have been conducted by NLAB and the Marine Corps. The prototype rigid box has met required performance standards. The prototype compressor unit was utilized during tests at MCDEC and performed to standards. NLAB is preparing the specifications for the compressor unit, which are scheduled for completion during the second quarter of FY81.

Test Schedule. Two refrigeration systems composed of standard reefer boxes and the prototype condenser units were tested at MCDEC in July and August 1980 as part of a test of the Marine Corps Field Feeding System. These units functioned according to standards. NLAB continues to work on the new refrigeration unit which will provide a freeze and chill capability. It will also be of the appropriate dimensions to fit within the 8'x8'x10' ANSI/ISO shipping frame when connected to the reefer box. DT/OT-II is scheduled for completion during the fourth quarter of FY81.

Development Problems. None.

Quantity. Current Marine Corps refrigeration units were generally replaced with new units on a cubic-foot-for-cubic-foot basis with two notable exceptions. In the area of food services, units were allocated a minimum of one unit even if it greatly exceeded their current refrigeration capacity. In the medical area, care was taken to ensure that medical units had the capability of stowing medical supplies, blood, and plasma while allowing sufficient cube to provide a temporary mortuary during peak casualty periods.

Replacing current T/E allowances will require an IO of 674 units distributed as follows:

FMF 60-Day Quantity		
• I MAF	145	
• II MAF	151	
• III MAF	136	
• IV MAF	143	
ORF	44	
Maint. Float	4	
General Support Forces	10	
Mobilization Training	2	
PWR	39	(63)*
Total	674	(698)*

Phase-in. The phase-in schedule of the refrigeration unit is as shown below.

	FY83	FY84	FY85	FY86	FY87	FY88	Total
Refrigeration box	90	60	173	189	88	74	674
Compressor unit	--	172	153	117	169	--	674

Cost. The estimated cost is $28,000 per system. This cost includes the procurement price of the box, the compressor, and the 10-foot shipping frame.

Post D-day 180-day requirement.

6.14 MOBILE ELECTRIC POWER DISTRIBUTION SYSTEM (MEPDIS)

Description. MEPDIS provides a more efficient and economical means of electrical power distribution in a tactical environment than is possible using current equipment. It consists of a collection of three sizes of distribution panels, cable, cable reels, and cable connectors. The system can be packaged in four QUADCONs and weighs 2,760 pounds. The distribution panels include the following:

- Two 100-kW panels, each capable of distributing four load connections of up to 100 amps.
- Six 30-kW panels, each capable of distributing four load connections of up to 60 amps.
- Eighteen 15-kW panels, each capable of distributing either 208-volt, 3-phase or 20-amp, 110-volt, single-phase loads.

Each set includes 50-foot cable assemblies and connectors to connect the distribution panels to the generator sets, other distribution panels, and the various loads. The MEPDIS is capable of distributing 60-Hz of power up to 1,100 feet from the primary source.

Replacement. MEPDIS is a supplement to the general illumination set and will replace the present field improvised power distribution systems. The new power distribution panels and cables will permit faster hookup and distribution of power by eliminating the extensive field wiring and load balancing now required. Additionally, unlike current equipment, MEPDIS can be removed following each exercise/operation in which it is employed and utilized again.

Development Status. Development of MEPDIS began in 1968. Prototype testing was conducted at MCDEC beginning in November 1976, and IOT&E was successfully completed at Camp Lejeune, North Carolina, during the fourth quarter of FY77. Field reports indicated complete satisfaction with the system and only a few correctable problems were encountered in its use. CEL has completed a purchase description for MEPDIS. Development of a prototype packaging system complying with ANSI/ISO dimensional and structural standards was completed during the fourth quarter of FY80.

Test Schedule. The prototype packaging system is scheduled to undergo development testing at MCDEC during the second quarter of FY81.

Development Problems. There are no development problems.

Quantity. Based on the power requirements for a MAF and the current power distribution equipment available, it has been determined that an IO of 51 units will be necessary and these units would be assigned as follows:

FMF 60-Day Quantity		
• I MAF	8	
• II MAF	8	
• III MAF	9	
• IV MAF	8	
General Support Forces	3	
PWR	15	(26)*
Total	52	(63)*

Cost. The estimated cost for each unit is $130,769.

Phase-In. The phase-in schedule for MEPDIS is shown below.

	FY82	FY83	Total
MEPDIS	32	19	51

6.15 AIR CONDITIONERS

Description. The Marine Corps will continue to employ standard air conditioning equipment to meet current requirements as well as to support the future introduction of MCESS and MCEMS. This equipment, listed below, consists of a family of nine air conditioning units which have been classified as standard in accordance with the Department of Defense standardization program. It should be noted that the first two units are designed for horizontal mounting on the wall of a structure and are not applicable to the support of MCESS/MCEMS since their shelter walls are not designed to accept horizontally mounted air conditioners. The remaining seven units are of upright or vertical design, which enables them to be employed in a freestanding manner within a shelter or positioned outside for remote operation with appropriate ducting between the unit and the shelter(s) supported. The remote mode of operation has been adopted for MCESS/MCEMS which is in conformance with MCO 10230.2A, USMC Standard Air Conditioners and Skid Assemblies, 7 August 1979.

*Post D-day 180-day requirement.

TAMCN	Nomenclature
B0001	Air conditioner, 60-Hz, 9,000-Btu, horizontal
B0002	Air conditioner, 60-Hz, 18,000-Btu, horizontal
B0003	Air conditioner, 60-Hz, 18,000-Btu, vertical
B0004	Air conditioner, 400-Hz, 18,000-Btu, vertical
B0005	Air conditioner, 60-Hz, 36,000-Btu, vertical
B0006	Air conditioner, 400-Hz, 36,000-Btu, vertical
B0008	Air conditioner, 400-Hz, 54,000-Btu, vertical
B0009	Air conditioner, 60-Hz, 9,000-Btu, vertical
B0011	Air conditioner, 60-Hz, 54,000-Btu, vertical/skid

The skid mounting kits identified below are employed to house designated vertical air conditioners during normal modes of embarkation, transportation, and operation. The kits also contain accessories needed to connect an air conditioner, operating in a remote mode, to the supported shelter.

TAMCN	Nomenclature	Air Conditioner Application
B2004	Skid Mounting Assy. Model SM-V18	B0003 B0004
B2006	Skid Mounting Assy. Model SM-V36	B0005 B0006

Replacement. There are no air conditioners being replaced solely on the basis of the introduction of MCESS/MCEMS. The additional units needed for this purpose will be selected and acquired from the family of standard air conditioners. The nonstandard air conditioners currently in use and which may be tentatively employed with a shelter through various conversions from vans, shops, etc., will continue to be replaced by standard units as rapidly as resources permit.

Development Status. No air conditioner development is required in view of the existence and acceptability of the standard units.

Quantity. Procurement requirements for air conditioners and skid assemblies are indicated below. They reflect total Marine Corps needs, including those to be acquired to support the introduction of MCESS/MCEMS, to meet the post-D-day 60-day requirement. The inventory objective (IO) for the current capability is shown for each item along with the objective to satisfy MCESS/MCEMS. The sum of these two objectives equals the total IO

according to the allocation of air conditioners and skid assemblies for the current capability and the allocation for MCESS/MCEMS as discussed in this plan.

The quantities of air conditioners required represent those to be procured to reach the 60-day IO in the case of MCESS/MCEMS (FLS), plus the designated level of IO fill in the case of the current capability. The designated level of IO fill is 100 percent or less depending on individual items and resource allocations in HQMC planning, programming, and budgeting.

The stratification of quantities to the FMF and other elements represents computed estimates in the case of MCESS/MCEMS. HQMC form P20A, 15 September 1980, was used as a guide in the stratification of each item. In the case of items required for attainment of the current 60-day IO, the stratification was based in certain cases on known allocations such as planned procurement for mobilization enhancement (ME). For those quantities to be procured for the general account, however, it was necessary to stratify the quantities in the proportions indicated for each item on form P20A.

TAMCN	B2004	B2006	Total
Current IO			
60 Days	1,312	606	1,918
180 Days	1,430	646	2,076
FLS Plan IO			
60 Days	3,129	2,202	5,331
180 Days	3,278	2,291	5,569
Total IO (60 Days)	4,441	2,808	7,249
FMF 60-Day Quantity			
• I MAF	754	446	1,200
• II MAF	744	433	1,177
• III MAF	674	406	1,080
• IV MAF	685	410	1,095
ORF	287	142	429
Special Mission Forces	257	119	376
General Support Forces	147	46	193
Mobilization Training	7	4	11
Mobilization Enhancement	173	117	290
Maint. Float	--	286	286
PWR	111	55	166
Total	3,839	2,464	6,303

The planned introduction of MCESS/MCEMS accounts for the major portion of the procurement requirements for air conditioners and skid assemblies. Determination of these

TAMCN	B0001	B0002	B0003	B0004	B0005	B0006	B0008	B0009	B0011	Total
Current IO										
60 Days	202	270	1,044	833	425	188	65	104	515	3,695
180 Days	208	283	1,098	861	492	193	65	108	543	3,851
FLS Plan IO										
60 Days	--	--	3,129	--	2,202	--	--	--	626	5,957
180 Days	--	--	3,278	--	2,291	--	--	--	658	6,227
Total IO (60 Days)	202	270	4,173	833	2,676	188	65	104	1,141	9,952
FMF 60-Day Quantity										
• I MAF	--	--	705	20	468	--	--	--	165	1,358
• II MAF	--	--	698	20	455	--	--	--	181	1,354
• III MAF	--	--	634	19	428	--	--	--	162	1,243
• IV MAF	--	--	630	24	431	--	--	--	183	1,268
ORF	--	--	239	38	151	--	--	--	92	520
Special Mission Forces	--	--	223	--	132	--	--	--	3	358
General Support Forces	--	--	121	28	52	--	--	--	12	213
Mobilization Training	--	--	6	1	5	--	--	--	3	15
PWR	--	--	70	4	56	--	--	--	31	161
Mobilization Enhancement	--	--	103	70	81	36	--	--	87	377
Maint. Float	--	--	--	6	294	--	--	--	--	300
Total		0	3,429	230	2,553	36	0	0	919	7,295

requirements took into consideration MCDEC Contract Study Report, MCESS Qualitative/ Quantitative Requirements Update (0063), 1 February 1979, and planned shelter allocations for MCEMS. The assignment of air conditioners to support equipment housed or to be housed in shelters also considered HQMC Contract Study Report, Validation of Inventory Data, End Item Lists, Modification Requirements, Procurement and Asset Utilization Plans for USMC Military Standard Air Conditioners, 13 October 1978. HQMC (Code LME-2) Listing of Air Conditioner Requirements by Table of Equipment Number, 16 March 1979, was used in conjunction with the above study report to specify air conditioners required for (allocated to) equipment.

The principal factor which contributed to an increase in quantitative requirements was the allocation of air conditioners to the family of small shelters that are to be regularly inhabited by personnel in the performance of their duties. Air conditioners were allocated to selected shelters not otherwise air conditioned to support operating equipment or for other purposes. The marked difference in requirements is illustrated below when air conditioners are provided for personnel comfort in selected work areas plus the support of operating equipment versus the provision of air conditioners only to support operating equipment. The figures pertain to II MAF, which was the only FMF element addressed by the MCDEC study. A common base of the British thermal unit (Btu) was used since many variables may cause the selection of a particular type/model of air conditioner from the standard family.

Personnel/Equipment Support FLS Plan	Equipment Support Only MCDEC Study
34,308,000 Btu	7,731,000 Btu

It should be understood that there were numerous minor variances observed in the source documents used in the MCDEC calculations and the FLS calculations. In addition, air conditioners for MCEMS were included in the FLS plan. These considerations influenced the comparison.

The term "air conditioning" considers both cooled and heated air provided by the Marine Corps family of standard air conditioners at operating temperatures ranges of 0^{o} to 125^{o} F for cooling and -50^{o} to 80^{o} F for heating. The need for heating at temperatures below -50^{o} F is briefly addressed later.

The matter of air conditioning policy or criteria was reviewed by HQMC representatives in conjunction with the development of this plan. All topics in the ensuing discussion were considered with a consensus that, for the present FLS planning, the quantitative requirements for air conditioners will be based on both equipment operating efficiency and

personnel comfort. These requirements will be reviewed later from the standpoint of providing air conditioners only for support of equipment and medical/dental functions included in distinct shelter conversion strata of the MCDEC study of 1 February 1979 (hard shelter to hard shelter stratum, soft to hard stratum, and a stratum for functions not currently in shelters which are to be housed in hard shelters). This effort has been accomplished and the results are reflected in a separate report, dated December 1980. Based on this detailed information, a determination will be made by HQMC of shelter requirements and, in turn, the allocation of air conditioners.

This matter is of special interest because of its impact on resources, electric-power generators, and deployment and operation of the FMF. The marked switch from a major reliance on tents to the use of hard shelters in many functional areas within FMF units has a direct bearing on the need for air conditioners to maintain the efficiency of equipment and/or personnel employed therein.

As a general rule, the Marine Corps currently authorizes air conditioners needed to ensure the proper operation of weapon systems and other mission equipment, and no air conditioners are authorized solely for personnel comfort at any temperature range. This rule of thumb is based upon the employment of soft shelters (tents) and a modest number of hard shelters (vans, relocatable buildings, and other full enclosures) which house a variety of electronic and similar equipment sensitive to environmental influences, such as temperature, humidity, and dust. As with any generalization, air conditioners may also be found in other working areas within FMF units.

The original study by MCDEC in 1974, which validated the shelter concept, as well as follow-on studies by MCDEC and HQMC, including two study reports in 1979, agree on the need to provide air conditioning necessary for the efficient operation of equipment. They also recognize in varying degrees that air conditioning is necessary for the healthful occupancy of 10- and 20-foot shelters by personnel. MCDEC Contract Study Report, Determination of FMF Expeditionary Shelter System Requirements, 16 May 1975, notes that if personnel comfort and morale ruled the allocation of air conditioners, the requirements would reach exorbitant levels of cost and electric power requirements would skyrocket. While this observation is valid, the impact of the lack of air conditioning on the efficiency and health of personnel is not addressed in the discussion. The original design specifications of the shelters by the Electronics Division of the Northrop Corporation contemplated employment of the shelter in a temperature range of -20^{0} to 120^{0} F. The aforementioned 1979 study report by MCDEC contemplates employment of the shelters in temperature ranges of -50^{0} to 125^{0} F (normal) and -50^{0} to -65^{0} F (arctic). Such employment accentuates the need to provide air conditioning (cool/heat) in some measure for both equipment and personnel.

Criteria or rationale are needed to guide the extent to which the shelters should be air conditioned to ensure their effective employment during military operations. When the existing hard shelters are employed, air conditioning is generally provided as required for the equipment it housed.

A few items of concern emerge from only a cursory review of the matter. First, the employment of personnel in fully enclosed shelters, such as the 8'x8'x10' and 8'x8'x20' (rigid and knockdown), without air conditioning will degrade their operating efficiency at a rate commensurate with the number of occupants of each shelter, period of occupancy, carbon dioxide level within the shelter, and the inside and outside temperatures. It is apparent that such shelter employment in desert areas, where temperatures may range in excess of 125^{o} F, is not reasonably appropriate since the temperature inside the shelter would quite likely render it uninhabitable, notwithstanding the excellent coefficient of transmission (U-factor) of the roof and sides of the shelter. At the other extreme, without air conditioning there must be some means of heating the shelters in cold weather temperatures of -20^{o} to -50^{o} F. Liquid-fuel-fired heaters commonly used in tents should not be used in the 10- and 20-foot hard shelters because of the fire hazards associated with the fuel, high oxygen utilization rate, and the lack of positive ventilation. Electric heaters provide a suitable alternative, but the electric power required for these heaters is about the same as the power required for air conditioners. For example, the 25,000-Btu electric heater draws approximately 7.3 kW of power whereas an 18,000-Btu air conditioner requires 6.0 kW and a 54,000-Btu air conditioner draws 10 kW. The maintenance workload, however, is lower for the heater than for the air conditioner.

The problem is lessened but not resolved if both extremes of temperature ranges are discarded and it is assumed that the shelters will be employed for the most part in temperate zones. A reasonable level of personnel efficiency could be maintained in noncritical functions inside the shelter at an outside temperature range of -20^{o} to 95^{o} F, provided the following steps are taken:

- Fans are furnished at the higher temperatures
- Warming tents or hard shelters with electric heaters are furnished at the lower temperatures
- Shelter doors and apertures are opened at warm temperatures

In these situations, however, it would be difficult to maintain light discipline during military operations.

The second item of concern is the investment required in operator/maintenance personnel and equipment to handle the workload associated with a great increase in air conditioners should they be authorized for a substantial portion of the hard shelters. While there is a separate discussion of electric-power generators, air conditioners create the major por-

tion of the requirement for generators. Accordingly, an increase in air conditioners causes an increase in power generators and a corresponding need for additional operator/maintenance personnel and equipment.

The third item is cost. The investment and recurring cost to acquire and operate air conditioners to accommodate the hard shelters of four MAFs is substantial. The cost of the associated power generators further increases this burden.

There are additional items of concern which bear on handling and transporting the air conditioners and generators as well as the diesel fuel required to operate the generators. Therefore, a criteria for the allocation of air conditioners is important to the efficient and effective employment of MCESS and MCEMS.

The MCDEC Contract Study Report of 1 February 1979 recognizes the air conditioning (cool/heat) problem. It mentions fans and tabulates heaters but does not analyze the additional electric-power requirements. The investment in fans would be significant but not substantial. On the other hand, the additional investment in heaters for -50^{o} to -65^{o} F temperatures would be substantial for both heaters and electric generators. It is noted again that the employment of MCESS and MCEMS at extreme temperatures (cold or hot) poses stringent considerations not generally applicable to tents, such as the need to use electric heaters in hard shelters while fuel-fired stoves may be used in tents.

Cost. The unit costs indicated below for the standard air conditioners and skid assemblies were derived from HQMC (Code LME-2) data for FY81 and escalated to FY82 to account for inflation.

Air Cond. TAMCN	FY82 Cost (Per Unit)	Skid Assembly TAMCN	FY82 Cost (Per Unit)
B0001	$ 5,076	B2004	$1,996
B0002	5,445	B2006	2,535
B0003	5,570		
B0004	5,751		
B0005	6,752		
B0006	7,950		
B0008	10,182		
B0009	4,634		
B0011	9,529		

Phase-In. The phase-in dates of the air conditioners and associated skid assemblies are indicated below. These dates are 1 year after the year of acquisition. In the case of air conditioners and skid assemblies for MCESS/MCEMS, the phase-in dates generally coincide with introduction of the applicable shelters.

Air Cond. TAMCN	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	Out Years	Total
B0003	103	532	490	414	223	288	316	388	675	3,429
B0004	70	160	--	--	--	--	--	--	--	230
B0005	60	381	532	248	157	202	223	269	481	2,553
B0006	36	--	--	--	--	--	--	--	--	36
B0011	69	285	110	72	44	55	66	77	141	919
Total	338	1,358	1,132	734	424	545	605	734	1,297	7,167

Skid Mounting Assembly TAMCN	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	Out Years	Total
B2004	479	497	625	348	223	288	316	388	675	3,839
B2006	74	441	369	248	157	202	223	269	481	2,464
Total	553	938	994	596	380	490	539	657	1,156	6,303

6.16 ELECTRIC GENERATORS

Description. The introduction of the MCESS and improved support services, including MCEMS, will require increased FMF electric-power generation. The shelters require power for lighting, air conditioning, and the operation of equipment housed therein. Additionally, a variety of planned service support modules, such as field feeding, sanitation, laundry, bath, and refrigeration units, are power consumers. Although, in many cases, FLS equipment will replace similar existing equipment, the net effect will be an increased need for electric power requirements. The Marine Corps will continue to employ the family of standard generators identified below to meet these and other electric-power requirements.

TAMCN	Nomenclature
B0730	Generator set, 3-kW, 60-Hz, skid-mounted
B0780	Generator set, 3-kW, 400-Hz, skid-mounted
B0891	Generator set, 10-kW, 60-Hz, skid-mounted
B0921	Generator set, 10-kW, 400-Hz, skid-mounted
B0953	Generator set, 30-kW, 60-Hz, skid-mounted
B0971	Generator set, 30-kW, 400-Hz, skid-mounted
B1016	Generator set, 60-kW, 400-Hz, skid-mounted
B1021	Generator set, 60-kW, 60-Hz, skid-mounted
B1045	Generator set, 100-kW, 60-Hz, skid-mounted
B1050	Generator set, 200-kW, 60-Hz, skid-mounted

The following supplementary items are members of the electric-power generation/distribution family in the Marine Corps.

TAMCN	Nomenclature
B0579	Dummy Load, electric, 100-kW
B0671	Frequency Convertor, 10-kW, 60 to 400 Hz
B0674	Frequency Convertor, 100-kW, 60 to 400 Hz
B0673	Frequency Convertor, 4-kW, 60 to 400 Hz

Replacement. No replacement program applies since the standard generators will continue to support both current and FLS planned equipment.

Development Status. No generators are being developed in view of the suitability of the existing family of standard generators.

Quantity. The procurement requirements for electric-power equipment are summarized below. They indicate total Marine Corps needs, including those to be acquired to support the introduction of FLS elements, to meet the post-D-day 60-day requirement. The inventory objective (IO) for the current capability is shown for each item along with the objective to accommodate FLS elements. The sum of these two objectives equals the total IO according to the allocation of equipment for the current capability and the allocation of FLS elements as discussed in this plan.

The quantities of electric generators required represent those to be procured to reach the 60-day IO in the case of MCESS/MCEMS (FLS), plus the designated level of IO fill in the case of the current capability. The designated level of IO fill is 100 percent or less depend-

ing on individual items and resource allocations in HQMC planning, programming, and budgeting.

The stratification of quantities to the FMF and other elements represents computed estimates in the case of MCESS/MCEMS. HQMC form P20A, 15 September 1980, was used as a guide in the stratification of each item. In the case of items required for attainment of the current 60-day IO, the stratification was based on known allocations in certain cases, such as planned procurement for mobilization enhancement (ME). For those quantities to be procured for the general account, however, it was necessary to stratify the quantities in the proportions indicated for each item on form P20A.

Generator, 60-Hertz

TAMCN kW	B0730 3	B0891 10	B0953 30	B1021 60	B1045 100	B1050 200	Total
Current IO							
60 Days	1,534	631	1,120	643	238	177	4,343
180 Days	1,635	647	1,265	737	274	206	4,764
FLS Plan IO							
60 Days	702	232	297	721	487	67	2,506
180 Days	750	238	336	826	562	78	2,790
Total IO (60 Days)	2,236	863	1,417	1,364	725	244	6,849
FMF 60-Day Quantity							
o I MAF	319	77	84	181	98	12	771
o II MAF	315	82	86	176	99	12	770
o III MAF	301	79	73	167	96	12	728
o IV MAF	309	86	78	172	94	12	751
ORF	99	30	19	43	47	11	249
Special Mission Forces	13	8	10	42	--	--	73
Gen Spt Forces	37	10	10	28	4	1	90
Mobilization Training	4	--	--	1	2	--	7
PWR	80	9	15	86	47	7	244
Mobilization Enhancement	258	109	144	75	27	--	613
Total	1,735	490	519	971	514	67	4,296

Generator, 400-Hertz

TAMCN kW	B0780 3	B0921 10	B0971 30	B1016 60	Total
Current IO					
60 Days	1,269	494	383	568	2,714
180 Days	1,347	510	435	645	2,937
FLS Plan IO					
60 Days	--	--	--	--	--
180 Days	--	--	--	--	--
Total IO (60 Days)	1,269	494	383	568	2,714
FMF 60-Day Quantity					
• I MAF	149	--	--	--	149
• II MAF	146	--	--	--	146
• III MAF	137	--	--	--	137
• IV MAF	156	--	--	--	156
ORF	47	--	--	--	47
Special Mission Forces	53	--	--	--	53
General Support Forces	9	--	--	--	9
Mobilization Training	4	--	--	--	4
PWR	34	--	--	--	34
Mobilization Enhancement	210	75	93	105	483
Total	945	75	93	105	1,218

	Frequency Convertor —60 to 400 Hertz—			Dummy Load	
TAMCN kW	B0673 4	B0671 10	B0674 100	B0579 100	Total
Current IO					
60 Days	271	467	220	185	1,143
180 Days	300	504	241	204	1,249
FLS Plan IO					
60 Days	--	--	--	--	--
180 Days	--	--	--	--	--
Total IO (60 Days)	271	467	220	185	1,143
FMF 60-Day Quantity					
• I MAF	--	37	33	16	86
• II MAF	--	40	33	14	87
• III MAF	--	37	33	15	85
• IV MAF	--	37	33	16	86
ORF	--	12	13	--	25
Special Mission Forces	--	9	--	2	11
General Support Forces	--	2	21	2	25
Mobilization Training	--	1	--	--	1
Maintenance Float	--	--	--	1	1
PWR	--	12	17	5	34
Mobilization Enhancement	--	--	--	25	25
Total	0	187	183	96	466

The documentation mentioned in the discussion of air conditioners is pertinent to electric-power-generator requirements. Additionally, Marine Corps Bulletin 10260 (Mobile Electric Power (MEP), 6 December 1978), was used for the current allocation of generators to FMF units, including level holders.

Power generating requirements for FLS planned items were determined by summarizing the additional 60-Hz loads imposed by the allocated air conditioning units, the new or improved service support modules, and lighting for the new family of shelters. Where a power-generating deficiency was identified due to the additional loads imposed, generator capacity to meet the requirement was assigned. A determination of the mix of generators best suited to a particular unit was included in the final equipment selection. While T/E units were given credit for existing 60-Hz electric power capability, such as present lighting capability for tents being replaced by hard shelters, there was no assumption made that units could absorb significant additional electric loads. Minor differentials were disregarded, however, when it appeared that the existing capability should suffice or the gener-

ators allocated approximated the calculated requirement. In these cases the number of kilowatts disregarded varied according to the total kilowatts in question and the degree of flexibility afforded by the allocated generators.

There is a significant difference between the additional requirements reported in MCDEC contract study of 1 February 1979 and this plan. Based on the current, planned allocation of FLS power-consuming elements, there is an additional requirement for 118,696 kW of electric power. This is indicated in the following stratification. The kilowatt is used as a common base since there are many variables that influence the selection of a particular generator from the standard family.

Power-Consuming Element	kW Required
Shelter Air Conditioning	+54,878
Shelter Lighting	+20,861
Field Feeding System	+24,300
Laundry/Bath Unit	+11,600
Sanitation Unit	+4,665
Water Purification System	+2,199
Refrigeration System	+674
Bulk Laundry System	-956
Bakery System	+475
Total additional kW	118,696

MCDEC reported 3,640 kW for the support of one MAF (II MAF), which was the only organization addressed in the study, while the additional power requirements noted above are for the support of four MAFs. The requirement reported by MCDEC related mainly to the additional power required for support of air conditioners for II MAF. Further, the MCDEC study did not include the major power-consuming elements of FLS, other than shelters, and provided no allocation of power for MCEMS. With the above considerations in mind, the net effect of adding power for air conditioning as allocated in this plan for both equipment and personnel is apparent. The additional power needed confirms MCDEC's belief that power requirements would skyrocket if air conditioners were added for personnel considerations. As noted in the previous discussion on air conditioners, this matter is the subject of a review of the allocation of shelters and air conditioners.

Cost. The unit costs indicated below for the standard generators and supplementary equipment were derived from HQMC (Code LME-2) data for FY81 and escalated to FY82 to account for inflation.

Generator TAMCN	FY82 Cost (Per Unit)	Supplementary Equipment TAMCN	FY82 Cost (Per Unit)
B0730	$ 5,428	B0579	$ 13,738
B0780	4,941	B0671	29,296
B0891	11,200	B0673	5,842
B0921	12,942	B0674	154,149
B0953	14,549		
B0971	15,866		
B1016	20,778		
B1021	18,400		
B1045	43,478		
B1050	50,725		

Phase-In. The phase-in dates of the generators and supplementary equipment are shown below. These dates are 1 year after the year of acquisition. In the case of electric power equipment to support FLS elements, the phase-in dates generally coincide with the introduction of the shelters and service support modules which require electric power.

Generator, 60-Hz TAMCN	kW	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	Out Years	Total
B0730	3	400	326	705	304	--	--	--	--	--	1,735
B0891	10	66	31	101	93	79	25	19	21	55	490
B0953	30	116	140	50	29	23	33	33	33	62	519
B1021	60	75	117	173	135	66	79	86	85	155	971
B1045	100	27	52	67	54	41	56	50	59	108	514
B1050	200	--	8	6	20	17	4	4	--	8	67
Total		684	674	1,102	635	226	197	192	198	388	4,296

Generator, 400-Hz TAMCN-kW		FY83	FY84	FY85	FY86	FY87	Total
B0780	3	60	231	217	225	212	945
B0921	10	75	--	--	--	--	75
B0971	30	93	--	--	--	--	93
B1016	60	105	--	--	--	--	105
Total		333	231	217	225	212	1,218

Supplementary Equipment TAMCN-kW		FY83	FY84	FY85	FY86	FY87	Total
B0579	100	96	--	--	--	--	96
B0671	10	--	45	142	--	--	187
B0674	100	--	70	50	--	63	183
Total		96	115	192	--	63	466

6.17 BULK LAUNDRY UNIT

Description. The laundry unit will be housed in an 8'x8'x20' rigid shelter and will be capable of washing and drying two 60-pound loads of laundry per hour. The laundry consists primarily of a washer, separate extractor, tumble dryer, and water heating and storage capability. It will require 5–10 kW to operate the system.

Replacement. The laundry unit will replace existing laundry units with the exception of those being replaced by the CLABU.

Development Status. A product-improved version of the M–352 laundry unit (now in service in the Army and Marine Corps) is currently under development at NLAB. The improved item being developed for the Army is trailer-mounted and is expected to be type classified early in FY81, following OT-II at Fort Bragg, the Quartermaster School at Fort Lee, and Aberdeen Proving Grounds. Procurement is planned by the Army in FY81. For Marine Corps use, the components must be removed from the trailer and mounted in a standard shelter. OT–II will include testing a water-recovery system and the use of cold water detergent. Power requirements should be reduced and it is estimated that water consumption will be reduced by 50 percent. Removing one water heater will reduce the weight of the system by 350 pounds. The detergent is designed for use with normal clothing

plus protective clothing (CB retardant, fire retardant, water repellant) and wash-and-wear material.

Test Schedule. The Marine Corps plans to monitor Army testing and will have NLAB begin designing a shelterized version for the Marine Corps during FY81. Previously scheduled tests were delayed due to administrative problems.

Development Problems. There are no development problems as the item is a relatively straightforward product-improved version of an existing standard military piece of equipment. The Marine Corps will provide an 8'x8'x20' shelter and $9,400 to NLAB during FY81 for the development of a shelter-mounted prototype, testing and modification of that prototype, and the preparation of an operations manual by second quarter, FY82.

Quantity. A total IO of 191 laundry units is proposed based on a need to support all elements of the MAF less the division and those units that normally provide direct support to the division that are serviced by the CLABU. The number of units recommended is further based on providing a clean change of clothes every 3 days with an operating time of 12 hours per day. Additionally, the number of laundry units currently authorized for the Medical Battalion were replaced on a one-for-one basis as the capacity of the new unit is basically the same as the one being replaced. The 191 laundry units are distributed as follows:

FMF 60-Day Quantity		
• I MAF	38	
• II MAF	38	
• III MAF	38	
• IV MAF	38	
ORF	20	
Maint. Float	4	
General Support Forces	1	
PWR	14	(29)*
Total	191	(206)*

Cost. The estimated cost of the laundry unit is $32,700, including the shelter. Laundry equipment costs are based on commercial prices.

Phase-In. The phase-in schedule for the laundry unit is indicated below.

	FY85	FY86	Total
Laundry unit	96	95	191

*Post D-day 180-day requirement.

6.18 BATH/SHOWER UNIT

Description. The bath/shower unit can be mounted and operated in an 8'x8'x20' standard Marine Corps shelter or it can be operated outside the shelter such as in a tent or in the open. The unit consists primarily of a multifuel water heater, suction hose, a strainer, a water pump, shower heads with individual valves with off-on position, and hoses and pipes to connect the shower heads to the hot water supply. Water can be drawn from sources up to 150 feet from the shower unit. The bath/shower unit will be equipped with a heater bypass plumbing arrangement so that, when necessary, cold showers may be taken.

Replacement. The bath/shower unit will replace the trailer-mounted bath unit with the exception of those being replaced by the CLABU.

Development Status. Development of this item closely parallels the development of the CLABU project. The major differences are that the CLABU shower units are individually modularized and possess an in-line electric hot water unit. Consideration is being given to changing the CLABU shower unit to the one described here.

Test Schedule. DT-1 commenced at CEL with the prototype unit in August 1980. As part of these tests, an "in line" water heater is being utilized to heat water before it reaches the shower heads. MCDEC has a shelter available for future tests.

Development Problems. There are no development problems associated with this item. With the exception of packaging the bath/shower unit to permit its operation inside or outside a standard shelter, the Army type-classified a bath/shower unit in 1979 that meets Marine Corps requirements.

Quantity. The Marine Corps purchased 80 new trailer-mounted, 24-nozzle field shower units in 1979 and 1980. Considering the improved inventory status resulting from the purchase of these units, life-cycle costs, and the reduced requirement for shower units generated by development of the CLABU, none of these items is required for procurement prior to FY90; therefore, no procurement is recommended at this time. However, an IO of 141 for the new bath/shower is proposed, considering reductions resulting from introduction of the CLABU. The 141 units would be distributed as follows:

FMF 60-Day Quantity		
• I MAF	29	
• II MAF	29	
• III MAF	29	
• IV MAF	29	
ORF	12	
General Support Forces	2	
Mobilization Training	1	
PWR	10	(20)*
Total	141	(151)*

*Post D-day 180-day requirement.

Cost. The estimated cost of the bath/shower unit is $19,600, including the shelter.

Phase-In. Not applicable at this time.

6.19 MARINE CORPS FIELD FEEDING SYSTEM (MFFS)

Description. The MFFS is an all-electric galley complex housed in standard MCESS shelters and supported by several other FLS items and modules. It will be capable of feeding troops in the field and when embarked in containerships. The galley configuration consists of five 8'x8'x20' shelters complexed together containing food preparation, serving equipment, and facilities sufficient to feed 1,000 men in 2 hours. The overall configuration is 8'x40'x20'. The food preparation equipment and two serving lines are contained in three rigid shelters. The two outboard knockdown shelters serve as access modules and provide insect, dust, and inclement weather protection to the galley and serving lines. The galley can be configured in two smaller sizes capable of supporting troops in separate locations. One galley shelter and 1 access module provide a company-sized mess facility (200 persons per 2 hours), while the other 2 galley shelters and access module constitute a facility that can feed 500 persons in 2 hours. The remaining elements of the complex are designed to support the total system as well as each of the smaller configurations. In addition to the five-shelter galley, the complex includes the following components:

- A sanitation unit housed in two 8'x8'x20' shelters. It contains an automatic tray-washing system and the necessary drain tables and sinks for washing pots and pans. The two shelters are normally complexed together but can be separated to support the smaller galley configurations.
- Two FLS refrigerator units.
- Two M-77 water heaters and two FLS water storage modules. The heater is fuel fired. Plans call for mounting these two units together in a QUADCON.
- Two QUADCONs for storage of dry stores.
- Three 60-kW generators provide power for the system. When operating in separate locations with the 2 smaller configurations, 2 generators will support the 500-man unit and 1 generator will support the company-sized mess.
- An electrical connect/disconnect package of necessary electrical cables and connectors.

Replacement. The field feeding system will replace current field mess equipment and supporting tentage.

Development Status. The MFFS is being developed by NLAB. Since much of the complex involves commercial food preparation equipment or FLS items addressed separately in this report, the development status of the system can be addressed in terms of the basic five-shelter galley. Three prototype MCESS shelters became available in FY79 and fabri-

cation of the galley and serving lines commenced. The ovens, steam table, and other equipment were purchased and mounted in the shelters. Shelter modifications, where necessary, were made to accommodate electrical and water supplies. Hood design and duct work planning and installation were accomplished to permit operation of the unit in the field. Two additional shelters were employed to provide a covered space for personnel being served and condiments tables.

Test Schedule. A five-shelter prototype was tested at MCDEC during July of 1980. Students at OCS were fed during a 10-day period utilizing the MFFS. Fresh food (A-rations) and canned (tray pack) rations were served during the tests. The formal test results will be available from NLAB during the first quarter of FY81. OT/DT II is tentatively planned during FY81.

Development Problems. Observation of the MCDEC tests indicate that the following problems existed and should be addressed in the NLAB report:

- The unit lacks the capacity to meet the specified quantity requirements for some A-ration meals.
- There are design problems with the steam table.
- Power meter readings require verification.
- Modifications should be considered which will provide better protection against flies.
- The prototype unit is vented through the roof, which is incompatible with shipboard use.
- The system was not set up in a field environment.

Subsequent tests should utilize generators rather than commercial power and the impact of air conditioning still needs to be tested.

Quantity. Based on an analysis of MAF unit geographical dispositions and an ability to support approximately 2,000 personnel with each system, a total of 135 field feeding systems are recommended. They would be distributed as follows:

FMF 60-Day Quantity	
• I MAF	31
• II MAF	31
• III MAF	31
• IV MAF	31
ORF	8
General Support Forces	1
PWR	2
Total	135

The above-stated requirement is considered tentative until a Required Operational Capability (ROC) for the MFFS can be developed. This should occur after an analysis of the MCDEC test results.

Cost. The estimated cost of the field feeding system is $189,000. The costs of refrigeration units, generators, and water modules are not included, as they are reflected separately in this report.

Phase-In. The phase-in schedule for the feeding system is indicated below.

	FY86	FY87	FY88	FY89	Total
MFFS	34	33	33	35	135

6.20 BAKERY SYSTEM

Description. The automated field bakery system is a military adaptation of state-of-the-art commercial breadbaking systems. It is a continuous-process baking system that, unlike present field equipment, produces products of consistent quality regardless of baking personnel skill levels and variations in ambient temperature and humidity. The system will be mounted in a shelter complex that meets ANSI/ISO standards. An Army-developed prototype is being monitored that produces 16,000 pounds of bread per day when operated 20 hours per day (two 10-hour shifts). The system is comprised of five major components which perform the following baking functions:

- The production unit mixes the ingredients, prepares the dough, places it in baking pans, and delivers the pans by conveyer belt to the proofer. The developmental prototype for this unit is being configured in a standard two-for-one Army expandable shelter.
- The baking unit consists of two nonstandard 8'x8'x20' containers with a two-level endless conveyer belt. The dough first passes through the proofer container and is then baked in the oven component. Baking temperatures are varied in the oven to ensure a quality product.
- The baked bread is then cooled and depanned. This unit will also be contained in a standard two-for-one Army expandable shelter.
- In the final component, the bread is sliced, bagged, and prepared for shipping to users. The development prototype for this component is configured in a standard two-for-one Army expandable shelter.
- Power for the system is provided by two dedicated 60-kW generators. One generator powers the system and the other provides an emergency backup to ensure an uninterrupted power supply.

Replacement. The automated field bakery system will replace the trailer-mounted baking plant, M-1945.

Development Status. This system is being developed by NLAB. A smaller capacity MAB-sized bakery unit will enter the R&D process in FY82. The smaller capacity bakery may ultimately be selected as the automated field bakery system for the Marine Corps.

Test Schedule. Testing of the Army prototype commenced during September 1980. DT/OT I is scheduled during second quarter FY81. The Army plans to procure five additional prototype bakeries in FY83 and FY84 for field testing. No firm schedule has been established for a Marine Corps bakery.

Development Problems. It appears that there are no foreseeable technical development problems that could not be overcome, as the bakery is essentially a military adaptation, albeit a complex one, of a commercial baking system. However, the Army has not decided whether or not to adopt the automated field bakery. In the event the Army decides against adoption, the Marine Corps must determine whether or not to proceed with unilateral development.

Quantity. A total IO of five automated field bakery systems is recommended for the Marine Corps. Distribution of the bakery systems is as follows:

FMF 60-Day Quantity	
• I MAF	1
• II MAF	1
• III MAF	1
• IV MAF	1
General Support Forces	1
Total	5

Cost. The estimated cost of the automated field bakery system is $816,000.

Phase-In. The phase-in of the bakery systems is indicated below.

	FY88	FY89	Total
Bakery system	3	2	5

6.21 SCRAPER, EARTHMOVING

Description. This item will be a motorized, self-propelled unit which loads, transports, spreads, and dumps earth in performance of a wide variety of road building and site preparation tasks. The item is primarily a commercial product with a proven performance in the construction industry. The exact size of the new item has not yet been determined, although a unit in the 14-cubic-yard capacity is considered appropriate to meet Marine Corps engineering requirements.

Replacement. The self-propelled scraper will replace the current 8-cubic-yard towed scraper which is pulled by the MRS 100 rubber-tired tractor. Eventual replacement of the current 16-cubic-yard scraper unit, which is also powered by a dedicated MRS 100-type tractor, is planned in order to achieve the benefits of a single item for logistical support. Replacement of both items is planned on a one-for-one basis.

Development Status. The self-propelled scraper unit being sought is of the type presently in use in industry and in the Army. During FY80, testing of three commercial scrapers was completed by MCDEC. The purpose of this testing was to evaluate the capability of commercial scrapers to meet Marine Corps requirements. Testing indicated that these scrapers should meet performance requirements. As a result, MCDEC is preparing design characteristics and performance specifications for a two-axle, self-propelled, single-engine, 14-cubic-yard version to be adopted for service use. This report is scheduled for delivery to HQMC during the first quarter of FY81.

Test Schedule. First article testing is scheduled for FY83.

Development Problems. Designated commercial versions of the 14-yard scrapers are outside the 8-foot width and height envelope of an 8½'x8'x40' commercial flatrack.

Quantity. The current full inventory objective for the 8-cubic-yard towed scraper is 55. The inventory objective for the 16-cubic-yard model is 28. In order to maintain the current earthmoving capacity, an IO of 74 self-propelled scrapers will be required. Allocation of these units is as follows:

FMF 60-Day Quantity	
• I MAF	14
• II MAF	14
• III MAF	14
• IV MAF	15
ORF	4
General Support	6
Total	74

Cost. The cost of a commercial self-propelled scraper unit in terms of FY82 dollars is estimated to be $128,600, depending on the size and complexity of the item selected.

Phase-In. All of the new scrapers will be introduced during FY84.

6.22 TRACTOR, FULL-TRACKED

This item has a diesel engine and is used with a variety of attachments to dig, level, and load earth and to tow other items of equipment. In addition, when equipped with a heavy winch, it is used to assist vehicles to traverse difficult beach terrain. The tractor weighs 53,560 pounds and is 144 inches high, 134 inches wide, and 225 inches long. The full-tracked tractor used by the Marine Corps is similar to earthmoving tractors of the same size range used in commercial construction.

Replacement. New commercial tractors are being evaluated as replacement candidates for the M82-30 tractor. The new tractor will replace existing tractors on a one-for-one basis.

Development Status. Evaluation of full-tracked earthmoving tractors is a part of a broader program of evaluating commercial earthmoving equipment of all types. Tests recently completed at MCDEC substantiated the capability of commercial earthmoving equipment to perform up to Marine Corps requirements. All commercial T-9-class tractors performed satisfactorily; however, the HI model TD20E provided the best interface with the LACH.

Test Schedule. Operational testing of replacement candidates for the M82-30 have been completed. A test report is scheduled for delivery to HQMC during the third quarter of FY81.

Development Problems. Army earthmoving equipment, although similar in nature, tends to be larger than that required to meet Marine Corps mission requirements.

Quantity. Procurement of 282 tractors is planned to begin in FY83. Allocation of these vehicles is as follows:

FMF 60-Day Quantity		
• I MAF	54	
• II MAF	51	
• III MAF	41	
• IV MAF	55	
ORF	24	
PWR	12	(30)*
Mobilization Training	1	
General Support	44	
Total	282	(300)*

Cost. The cost of the tractor is estimated to be $140,700 in terms of FY82 dollars, based on an escalation of 9 percent over the FY81 unit cost.

Phase-In. The new tractors are scheduled for introduction as shown below.

	FY84	FY85	Total
Tractor, full track	79	203	282

6.23 LUBRICATION SERVICE UNIT

Description. This item is a skid-mounted module consisting of tanks, pumps, air compressors, hoses, grease guns, and other accessories needed to lubricate and service vehicles and equipment. The current trailer-mounted lubrication and service unit is powered by a small gasoline engine. It weighs 2,740 pounds and is 70 inches high, 48 inches wide, and 96 inches long.

*Post D-day 180-day requirement.

Development Status. There is no development in progress. However, it is recommended that a development program be initiated to ensure that the diesel engine selected to power the unit is capable of being housed in the equipment envelope and that the unit is modularly suited for shipping frame compatibility.

Test Schedule. To be developed.

Development Problems. The selection, test, and evaluation of a small diesel engine capable of powering the unit may present problems due to its size, weight, and compatibility with existing auxiliary equipment.

Quantity. The IO for the lubrication service unit is 289. Procurement is planned in the FY82-86 period. Allocation of these units is as follows:

FMF 60-Day Quantity		
• I MAF	62	
• II MAF	55	
• III MAF	49	
• IV MAF	68	
ORF	21	
Maintenance Float	15	
General Support	7	
PWR	12	(29)*
Total	289	(306)*

Cost. The estimated cost of the lubricator is $28,300 in terms of FY82 dollars.

Phase-In. The phase-in schedule of the lubricator is indicated below.

	FY84	FY85	FY86	FY87	Total
Lubricator	74	83	84	48	289

6.24 STEAM CLEANER UNIT

Description. This item is a skid-mounted module which generates a high-pressure water jet and high-pressure steam at a portable nozzle for use in removing accumulated grease and dirt from vehicles, engine equipment, and similar machinery. Power is derived from a diesel engine and an oil-fired heat transfer unit.

Replacement. This skid-mounted item will replace current trailer-mounted equipment on a one-for-one basis.

Development Status. The Marine Corps evaluated and procured commercial-type Sioux steam cleaners as an interim replacement for the current tactical units. The U.S. Army has

*Post D-day 180-day requirement.

designed a replacement unit and has drafted a specification for the new item. The Army plans to procure test items during December 1980 with delivery scheduled for May 1981.

Test Schedule. Marine Corps will begin testing units during June 1981.

Development Problems. The steam cleaner has had a very low priority during the development process.

Quantity. Procurement of 392 of the skid-mounted items is planned. Consideration is being given to the possibility of using this item to replace 460 decontamination units. Allocation of these units is as follows:

FMF 60-Day Quantity	
• I MAF	98
• II MAF	91
• III MAF	79
• IV MAF	99
ORF	16
Mobilization Training	1
General Support	8
Total	392

Cost. Estimated cost in FY81 dollars is $6,900.

Phase-In. The phase-in schedule of the steam cleaner is indicated below.

	FY87	FY88	FY89	FY90	OY	Total
Steam cleaner	65	62	99	89	77	392

6.25 AMPHIBIOUS ASSAULT FUEL SYSTEM (AAFS)

Description. The AAFS is composed of a number of self-contained components capable of receiving, transferring, and dispensing motor, diesel, or jet fuels. The system is basically oriented to handle one product although exceptions have been made in the past. Each AAFS consists of a beach unloading station, two drum unloading units, two booster stations, two dispensing stations of six outlets each, and five tank farms of 120,000 gallons capacity each. Each tank farm has six 20,000-gallon collapsible fuel storage tanks. The system can be set up in a wide variety of configurations to meet varying operational requirements. It can receive and transfer to storage from naval craft up to 10,000 feet offshore through sea unloading lines at a rate of 600 gpm. Fuels can also be received and transferred from drums, LVT- or truck-borne tanks at a minimum rate of 150 gpm and from

bulk tanks, railroad tank cars, and the fuel trucks at a rate of at least 200 gpm. It is possible to dispense fuel to vehicles, containers, tank trucks, aircraft, and refuelers at a rate up to 350 gpm.

Replacement. None. Funds are planned to upgrade systems during FY82–86.

Development Status. This item is currently in service and is carried in the T/E of the Bulk Fuel Company of the Engineer Support Battalion, FSSG. The AFFS currently interfaces with the Navy's offshore system which has a 6-inch line and pumps 600 gpm. The Navy is developing an 8-inch bottom-laid line with an 800-gpm capability. CEL is also developing a beach interface unit in house which would enable the AAFS 6-inch system to connect with the 8-inch Navy system. The report of a study conducted by CEL to determine the methods of packaging portions of the system to make it compatible with ANSI/ISO containerization standards has been completed. It is being processed as a technical memorandum at CEL and should be released early in 1981.

Test Schedule. The new interface unit and pump control will be tested during the Navy offshore tests in the second quarter of FY81 at CEL.

Development Problems. None.

Quantity. Procurement of the equivalent of 20 current AAFS is planned.

Cost. $1,064,000 per system.

Phase-In. The phase-in schedule for AAFS is indicated below.

	FY83	FY84	FY85	FY86	Total
AAFS	5	4	5	6	20

6.26 TACTICAL AIRFIELD FUEL DISPENSING SYSTEM (TAFDS)

Description. The TAFDS is an assembly of components capable of receiving, storing, and dispensing aviation fuel. The system consists of six 20,000-gallon capacity collapsible tanks, three trailer-mounted 350- and/or 600-gpm fuel pumps, skid mounted filter-separators, meter assemblies, a manifold assembly, drum unloading unit, six dispensing stations, and assorted hoses and nozzles, etc. The TAFDS is capable of receiving fuel from the AAFS transfer lines at the rate of 600 gpm or from auxiliary ground carriers and drums at a rate of 200 gpm. It is capable of refueling six aircraft simultaneously.

Replacement. None.

Development Status. This item is currently in service and carried in the T/E of the Engineer Squadron, MAW. The Marine Corps is currently replacing the 10,000-gallon collapsible bags with 20,000-gallon bags and upgrading the fuel pump to a 600-gpm unit. Other

product improvement efforts planned or underway at CEL include improving the system's all-weather capability, configuring portions of the system to be compatible with ANSI/ISO containerization standards and developing an automatic pump control capability. The latter improvement will permit a more efficient and faster aviation refueling capability with fewer personnel.

Test Schedule. Not applicable.

Development Problems. None.

Quantity. Procurement of the equivalent of 16 current systems is planned.

Cost. $156,900 per system.

Phase-In. Eight per year will be phased in during FY84–85.

6.27 HELICOPTER EXPEDIENT REFUELING SYSTEM (HERS)

Description. The HERS is a helicopter transportable system developed to provide a refueling capability for helicopter operations from forward areas where TAFDS and AAFS are not available. The system has been effectively used to support ground units as well. Particular emphasis with refueling tanks and LVTs during long distance displacements as armored columns has been effective. HERS consists of 12 collapsible fuel tanks with a capacity of 500 gallons each, plus 2 gasoline-driven pumps, filter/separator assemblies, meters, and assorted hoses, nozzles, etc. The total system storage capacity is 6,000 gallons and its weight, including fuel, is 46,073 pounds.

Replacement. None.

Development Status. The item is currently in service and is carried in the T/E of the helicopter groups. A deficiency does exist in HERS, as the 50-gpm pump, organic to the system, does not have the capability of refueling two AV–8A aircraft simultaneously. In order to provide this AV-8A refueling capability, MERADCOM has prepared specifications for a diesel fired motor to operate a new 100-gpm pump (described in paragraph 6.6). This pump will replace the 50-gpm pump.

Test Schedule. Not applicable.

Development Problems. Not applicable.

Quantity. A total of 18 HERS units are authorized each Marine Wing Engineer Squadron. This quantity is considered adequate and no changes in T/E are recommended.

Cost. $50,000 per system.

Phase-In. Not applicable. These units are currently operational in the FMF.